

**SOCIAL TIES, HEALTH CARE ACCESS, AND HYPERTENSION RISK AND
MANAGEMENT BEHAVIORS AMONG GHANAIAN OLDER ADULTS**

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Abstract

Purpose:

Cardiovascular disease accounts for a significant proportion of the disease burden in Ghana. Hypertension is of high prevalence and a leading risk factor in Ghana. Levels of risk behavior, awareness of diagnostic status, and appropriate management are inadequate and avenues for intervention need to be explored. Social relationships have been found to have significant associations with health behaviors in numerous studies, although much of the evidence stems from studies conducted in developed country contexts. This study examines the association of a composite measure of social ties with cardiovascular risk behavior among a nationally representative sample of Ghanaian older adults. It also assesses what access to care factors may be associated with diagnostic awareness.

Methods:

Data from Ghana Wave 1 dataset of the WHO Study on global AGEing and adult health (SAGE), a multi-country longitudinal survey of older adult well-being and health. Physical activity was measured using the GPAQ instrument, tobacco use was based on response to a question on current use of any tobacco products, and fruit and vegetable intake was based on responses to two separate questions regarding servings of fruits and vegetables consumed in

a typical day. Social ties included dichotomized variables of marital status, regular attendance at religious services, regular attendance at voluntary group meetings, and frequent socialization with friends and coworkers. A composite index was created from these ties. Awareness was based on self-reporting of known hypertension status. The prevalence ratio associations between each CVD risk behavior, the specific social ties, and the composite index were assessed using adjusted robust Poisson regression models.

Results:

Having health insurance and utilizing outpatient care in the prior 12 months were associated with increased awareness. There was evidence of associations between different social ties and cardiovascular risk behaviors, and they may differ between men and women of a nationally representative cohort of older Ghanaian adults. The association was not always protective. A composite index was only significantly associated with physical activity.

Conclusion:

Access to care may be a barrier to diagnostic awareness. The findings also support prior studies on the importance of social ties in risk behavior and disease management.

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Abbreviations

BMI	Body mass index
BP	Blood pressure
CI	Confidence interval
CIDI-SF	Composite International Diagnostic Interview Short Form
CVD	Cardiovascular diseases
DALY	Disability adjusted life years
DBP	Diastolic blood pressure
EA	Enumeration area
GDP	Gross domestic product
GNI	Gross national income
GPAQ	Global Physical Activity Questionnaire
ICD-10	International Classification of Disease, tenth edition
ICPSR	Interuniversity Consortium for Social and Political Research
IQR	Interquartile range
LMIC	Low and middle income countries
MET	Metabolic equivalent
NCD	Non-communicable diseases
NHIS	National Health Insurance Scheme
PCA	Principal component analysis
PPP	Purchasing power parity
PR	Prevalence ratio
SAGE	Study on global AGEing and adult health
SBP	Systolic blood pressure
SE	Standard error
SNI	Social Network Index
US	United States
UN-HLM	United Nations High Level Meeting
VIF	Variance inflation factor
WHO	World Health Organization
WHODAS	World Health Organization Disability Assessment Schedule
WHS	World Health Survey

Chapter 1: Introduction

Background and Rationale

Advances in medicine, technology, and economic development in the last century have galvanized enormous improvements in mortality and morbidity across the globe, particularly in developed countries[1–4]. Gains in the prevention and treatment of infectious diseases have brought about vast improvements in quality of life and life expectancy [1–6]. In developed countries, the major causes of mortality and morbidity have shifted from largely infectious diseases and nutritional deficiencies to those that are predominantly chronic and degenerative in nature, such as heart disease, cancer, diabetes, and stroke [2, 3, 5]. This shift, or epidemiologic transition, is theorized to occur in societies alongside improvements in technology and economic advancement [3, 4, 7]. While developing countries also experienced positive changes in mortality and morbidity from infectious and nutrition-related diseases, these conditions continue to account for significant mortality and morbidity burdens in those countries [3].

In the last half century, reductions in nutritional deficiencies, improvements in the prevention and treatment of infectious diseases, and significant investments in public health programs in developing countries have led to declines in fertility and increased life expectancy [3, 6–9]. Improvements

in health in early life, increasing life expectancy and proportion of older adults in the population, migration of rural populations to urban centers, and the consequent uptake of risk behaviors in diet, physical activity, alcohol consumption, and tobacco use have contributed to a shift in the pattern of disease burden across the globe [8, 10–12]. Non-communicable diseases (NCDs) such as cardiovascular disease (CVD), diabetes, and cancer have now become major causes of mortality and morbidity, accounting for 65% of mortality and 54% of disability adjusted life years (DALY) lost in 2010 [13–16]. Nearly 80% of the global NCD burden is in low and middle income countries (LMIC) [14, 15, 17]. This has been attributed to the rapid aging of the populations, urbanization, and increasing risk behaviors in LMIC [11, 15, 18–20]. There are enormous health and economic impacts from this burden [21–26]. Already taxed with addressing the continuing burden of infectious diseases, health systems in developing countries are challenged to address the growing burden of NCDs [27–30]. Furthermore, current systems of care are designed to address the acute and episodic nature of most infectious conditions, whereas NCDs require a continuity of care in which the patient and their social relations play a vital role [30].

Cardiovascular disease is the leading cause of mortality globally, with 80% of deaths occurring in LMIC [18, 31]. This burden is expected to increase as

the socio-economic conditions of countries improve and the proportion of older adults increase [18]. Hypertension is an important risk factor for CVD and has high prevalence in Ghana and other developing countries. However, the likelihood of diagnosis, treatment, and control are very low [18, 20, 32].

Prevention and management of NCDs require health systems to undertake multi-sectoral, multi-level intervention approaches [33]. Awareness is a necessary motivation for engaging in preventive and treatment behaviors. The high prevalence of hypertension in Ghana and other developing countries, but low levels of awareness are indicative of constraints in the provision and receipt of diagnostic services for prevention and early detection of hypertension and other chronic conditions. Challenges in accessing care may play an important role for awareness [34]. Supply side factors that affect access, utilization, and quality of care may have important implications for awareness of hypertension status.

Ageing has been strongly associated with increased risk for CVD, yet there is little focus on interventions that integrate both the needs of CVD prevention and management and the promotion of healthy ageing [35]. Characteristics of a person's social environment and social relationships, such as loneliness and social participation, have been shown to have important influences on health and health behavior, including prevention and management

of NCDs [36–40]. Furthermore, social relationships are independently important in the overall well-being of older adults [35]. Few studies have examined the role of social relationships in risk behavior and management of CVD risk factors such as hypertension, smoking, and inadequate physical activity among older adults in developing countries. Research is therefore needed in this area in order to inform the development and implementation of effective policies and interventions. This introduction will define and discuss health systems factors and key concepts of social relationships relevant to this analysis.

Social relationships and health

A significant body of research has shown that the social environment and social relationships play important roles in disease incidence, severity and mortality [41–45]. An early longitudinal study in Alameda County, California found that the presence of social ties such as marriage, contacts with family and friends, church membership, participation in formal and informal group associations, and a composite social integration index were protective of mortality from several causes, even after adjusting for common risk factors such as age, baseline health status, physical activity, obesity, smoking, and alcohol consumption [46]. Another prospective study by House et al using a longer follow-up period and controlling simultaneously for multiple confounding risk

factors, also showed strong support for this association, finding that marital status, attendance at voluntary association meetings, and engagement in social leisure activity were associated with decreased risk of mortality for men, while church attendance was so associated for women [47]. The findings also suggested that the effects of the different types of social relationships was cumulative, with the presence of multiple relationships improving the effect when compared with the presence of just one relationship type [47]. Thus, the different relationships may impact on mortality through different pathways and may not be completely substitutable. A cumulative index of social relationships and activities remained significant for men after adjusting for age and other covariates, but was not significant for women after adjusting for covariates besides age [47]. In an early review of studies examining the effects of social relationships on mortality and morbidity, the authors noted that the available evidence satisfied 4 important criteria for strong causal relationship: strength and consistency of association, temporality, gradient in the response, consistency between experimental and observational data, and theoretically plausible explanation for the observed associations [36]. A recent meta-analysis of 148 studies provided further evidence of the significant impact of social relationships on mortality from a variety of causes, increasing the odds of survival by 50% [48].

There are many ways in which to conceptualize and describe the characteristics of social relationships that are critical in promoting health. The structure and function of these ties are theorized to operate separately in influencing health and correlate weakly [49]. The qualitative and functional aspect of social relationships, social support, has been theorized to influence health through the provision or perceived availability of physical and psychosocial resources that are important for promoting coping, esteem, and feelings of belonging [50, 51]. Results from several studies underlie the importance of social support in promoting health and good adherence practices [52–55]. The structural characteristic of social relationships, social integration, emphasizes the importance of the number of contacts an individual has within a social network and the frequency of interactions with those contacts [52, 56]. The importance of social integration in predicting health and mortality outcomes has earlier been discussed [36, 46, 47].

Several pathways link social integration with health outcomes [52]. Through a psychological pathway, the resources available to a well-integrated individual in a network may influence health outcomes and health-promoting behavior by improving self-efficacy, promoting adaptive coping, and improving mood and outlook [52, 57–59]. This has been found to be especially important among older adults [60, 61]. Through a physiological pathway, social integration

may influence the onset and progression of disease, with consequent impact on morbidity and mortality [52, 59]. The social support available to a well-integrated individual may buffer against cardiovascular reactivity induced by stressful events [59, 62–68]. Another theory suggests that isolation, or lack of integration, is associated with increased rate of aging and suppressed immune function [52].

Social relationships may also influence mortality and morbidity outcomes through health behaviors such as smoking, alcohol consumption, physical exercise, and treatment adherence [52, 56, 57, 69, 70]. A person's social network may work as supports for dealing with health problems, as well as sources of social control by imposing norms for expected and observed health promoting and, at times, health damaging behaviors [56, 71, 72]. In the Alameda County study, Berkman and Syme found that social integration was not only associated with mortality, but similarly with health practices [46]. There were gradients in the association between social isolation and risk behaviors, with increasing levels of isolation being associated with increasing likelihood of poor health behaviors such as smoking, physical inactivity, and alcohol consumption [46]. Other studies have found that social integration concepts have been associated with physical activity [70, 73–76], smoking [70, 74, 77], diet [70, 78, 79], and treatment adherence [71, 80, 81]. However, measures of social relations that account only

for the structure (number of connections, frequency of contacts, quality of contacts) as opposed to the functional roles of these contacts, are less likely to be associated with general health behaviors such as healthy diets, physical activity, and smoking [71]. Structural measures, such as social integration, are more likely associated with health behaviors that are less common within a person's social network, such as the management of a chronic condition [71].

Four types of social ties are commonly assessed for their impact on health and health behavior: marital status, religious participation, engagement in social activities with relatives and close friends, and participation in voluntary organizations or clubs [43, 46, 82–84]. There is a large body of research that has elucidated the associations between each of these ties and individual health and well-being [45, 46, 80–85]. Being married has been associated with reduced incidence of and mortality from disease [46, 47, 86, 89] and higher reported levels of psychological well-being [87–89]. Members of a person's social network with very close ties, such as spouses, can exercise greater social control of the health behaviors of that person, as well as being most likely to provide specific social support [71, 85]. Umberson notes that the effect of marital status on health promoting behavior is greater for men than women, due largely to established gender roles in which women are more likely to be monitoring the health and well-being of other family members [85].

Engagement in regular activities with relatives and close friends is important for social integration, and these connections provide a sense of belonging and self-esteem [52]. Such participation not only provides a context within which the individual situates his or her own identity, but also enable companionship with others [52, 56].

The association between frequent attendance of religious services and mortality has been studied extensively, and many have found positive associations between the two. Studies have found associations between religious involvement and chronic conditions including hypertension [91]. There are several reasons posited for this observed relationship [92]. One possibility is that certain religious traditions may have rules that mandate healthy behaviors such as abstention from alcohol and tobacco use, as well as reverence for the physical body and adherence to medical treatments [93]. Religious attendance may provide a larger network of social support, and thus helpful for countering the effects of stressful life events [74, 92, 93]. This network may also be a source of health information and guidance for dealing with the emotional and physical toll of diseases [91]. Likewise, participation in voluntary groups and clubs fosters a sense of belonging in and attachment to a community [56].

While there has been considerable evidence of the associations of social relationships with health and mortality, much of the evidence stems from studies

conducted in developed countries. A smaller body of literature has explored the theorized mechanisms by which social integration affects mortality, with no studies identified by this researcher conducted in the context of older adults in developing countries. The developing country context presents a unique opportunity not only to examine these associations in a different cultural milieu but also in a context experiencing increasing economic and social development, urbanization and the changing dynamics of social relationships. This study seeks to use the theorized relationship between social ties and health behavior to explore the association between measures of social integration and outcomes related to the management of hypertension in a nationally representative sample of older Ghanaian adults.

Health systems factors in hypertension awareness and treatment

Factors that affect care seeking and health service utilization impact severely on the awareness of disease. In a systematic review of health systems barriers to awareness and treatment of hypertension, Maimaris et al found that geographical availability, quality and training of health providers, cost, and insurance have important implications for awareness and treatment of hypertension [94]. Most of the studies relating health systems factors to awareness, care seeking, and control of hypertension were conducted largely in

the US and other developed countries [94]. One study in Ethiopia found that having to travel long distances to a health facility hindered adherence to medication [95], while another in Cameroon found no association between costs of medications and awareness [96]. In a sample of peri-urban South Africans, there was no significant association found between type of provider and level of blood pressure control [97], although type of provider, costs, and infrequent contacts with health provider were significant for adherence behavior in a Brazilian sample [98].

Beyond these traditional factors that affect access to and utilization of health services, the quality of interactions between health care providers and patients play an important role in care-seeking and health outcomes. The concept of health system responsiveness seeks to capture the quality of interpersonal processes that occur between patient and provider during an encounter [99]. It focuses on the non-clinical aspects of care provision, as opposed to expectations of clinical outcomes, and can be conceived of in two broad categories: respect for the individual patient and the general client orientation of the health system in the provision of services [100]. Respect for the patient entails the autonomy of the patient to decide on the course of treatment, confidentiality and privacy of the patient's personal information and the right to safeguard access to such information, and respect for the dignity of the patient as

a person. Patient centeredness in the provision of services is also multidimensional and encompasses the following domains: prompt attention when patient seeks care, quality of basic amenities in the place of care, freedom to choose who provides the needed care, and access to social supports [99, 100]. A patient's perceptions of these processes may impact on satisfaction with care [101], to follow through on provider's instructions, and subsequent decisions to seek care [99, 102]. In order to address the lack of awareness of hypertension diagnostic status among older Ghanaians, it is important to understand the role traditional barriers of health care access as well as the perceptions of the health care encounter.

Ghana demographic, economic, and health profile

Ghana is a lower middle income country situated on the west coast of Africa, bordered on the north by Burkina Faso, on the east by Togo, on the west by Cote d'Ivoire, and on the south by the Gulf of Guinea. It spans an area about the size of the US state of Oregon, divided into ten administrative regions. It has a tropical climate, experiencing a rainy season between April and July. Between January and March, the dry and dusty harmattan winds blow south from the Sahara Desert. The southern part of the country tends to be wetter and more humid than the drier north. In 2012, Ghana's population was estimated to be 25

million people, 30% higher than the 2000 estimate [103]. Females make up 51.2% of the population [103]. Of the 10 administrative regions, the Ashanti, Eastern, and Greater Accra regions are most populous, together comprising 46.5% of the total population [103]. Slightly more than half the population live in urban areas [104]. Since 1960, the proportion of the population that is 60 years and older has consistently increased, from 4.5% in 1960 to 6.7% in 2010 [103, 105].

Relative political stability and the promise of economic prosperity through the exploitation of newfound oil reserves has made Ghana an attractive target for foreign investment, resulting in significant economic growth in the last few years. Ghana was recently ranked as one of the fastest growing economies in the world, experiencing GDP growth of more than 14% in 2011 [106]. GNI per capita improved from \$1,610 in 2010 to \$1,810 in 2011 [106]. In 2011, it was estimated that 28.6% of the population lived below the poverty threshold of less than \$1.25 PPP per day [107]. Ghanaians have an average life expectancy of 61.4 years, and the country is ranked 140 out of 188 countries in the 2015 Human Development Report [107].

Infectious diseases continue to be the leading causes of mortality, with malaria, maternal and child-specific causes of death contributing the most to the burden of disease [104]. However, NCDs are significant contributors to the disease burden, accounting for 42% of total mortality in 2012 [104, 108]. Health

service utilization indicators are generally better than other comparable WHO Africa region countries, although per capita total health expenditure has tended to be lower [104]. In 2013, total health expenditure was 5% of GDP, with 61% of this being accounted for by general government health expenditure and 39% through private health expenditure [109]. Ninety-two percent of private expenditure is through out of pocket payments [109]. Since the introduction of the National Health Insurance Scheme (NHIS) in 2005, uptake has generally been low, with an estimated enrollment of 35% in 2012 [110] and 38% in 2013 [111]. The NHIS aims to cover treatment of 95% of the most common health conditions in the country, including infectious, maternal and child health services as well as chronic conditions such as hypertension [110–112].

Cardiovascular diseases such as stroke and ischemic heart disease accounted for 18% of total premature deaths in Ghana in 2012 [108]. Hypertension is a leading risk factor for CVD in Ghana, and has remained one of the top five causes for outpatient visits since 1990 [113]. Previous studies of hypertension in Ghana have revealed high prevalence, although these studies have been in selective populations and have not been nationally representative [114]. Nevertheless, they allude to a trend of increasing prevalence among both urban and rural populations [114, 115]. Tobacco use, inadequate fruit and vegetable consumption, and physical inactivity also remain important risk

factors for CVD [116], and are critical aspects of the management of hypertension [117].

Rationale

The increasing burden of chronic non-communicable diseases and the potential health, social, and economic implications, particularly for LMICs, have been widely recognized [1, 12, 118–121]. At the same time, these countries continue to experience high levels of infectious diseases, and thus have health systems facing a double burden of diseases [1, 2, 9, 122]. Insufficient attention and resources have been committed to addressing the prevention and management of NCDs [17, 33]. In Ghana, there has been limited funding for the prevention and management NCDs, as much of health systems funding is geared toward the traditional focus on acute and infectious conditions [123]. The United Nations High Level Meeting on the Prevention and Control of NCDs (UN-HLM) in September 2011 brought to the fore the urgent need for comprehensive, coordinated, and multi-sectoral efforts to address the control and prevention of NCDs [124].

A major difficulty for the control of NCDs in LMIC, particularly conditions that are largely asymptomatic, is the lack of awareness of diagnostic status [115, 125]. Systematic surveillance of NCDs is weak or non-existent in

Ghana and other LMICs [1, 12, 119, 126]. Awareness of hypertensive status requires regular contact with the health system, and thus is hampered by systemic barriers to care. In Ghana, this includes the traditional barriers of cost and availability of insurance [127]. Even when care is available, the quality of the provider and the responsiveness of the health system may be important factors in the decision to access care, and will therefore impact on the likelihood of diagnosis [101, 128]. To address the growing prevalence of hypertension and attendant lack of awareness in Ghana, it is imperative to explore the importance of these factors and their association with level of awareness.

While hypertension can be effectively managed through medication and changing risk behaviors among those who are aware of their diagnostic status, adherence to medications and uptake of appropriate behaviors tend to be low [118]. A large body of research has shown that the social environment in general and social networks in particular play important roles in the prevention and management of diseases [44, 47, 129]. Furthermore, social relationships are important for the overall well-being of the individual, and particularly among older adults [35]. However, these associations have received minimal research attention in developing country contexts. As the Ghanaian Ministry of Health has drafted strategic plans to address the burden of NCDs [123], it is important that evidence for all potential avenues for intervention are explored.

The WHO's Study on global AGEing and Adult Health (SAGE) presents an important opportunity to examine these relationships and their potential for interventions. SAGE is a multi-country, longitudinal study designed to collect data on the health and well-being of older adults [130]. Along with a wealth of data on demographics and health status, SAGE also collects data on social relationships of respondents. It provides a nationally representative sample of older adults in Ghana, and makes it possible to explore the association of social relationships and hypertension management behaviors, as well as the factors that affect awareness, with results that can be generalized to the Ghanaian population.

Purpose, Aims, and Research Questions

Purpose

The purpose of this study is to explore one of the theorized pathways in which social relationships influence mortality and other health outcomes. Specifically, the study will examine the association of social ties and social integration with risk behavior and proper management of hypertension among a nationally representative sample of Ghanaian older adults. It will test how marital status, social participation, religious participation, and voluntary group membership, the specific components of a social network index, individually and

synergistically influence risk behavior and hypertension management. A prerequisite for treatment and management is awareness. Therefore, this study will also examine what health systems and access to care factors may influence awareness of hypertension status among older Ghanaians.

Specific Aims and Research Questions

Aim 1: To examine the associations between marital status, engagement in social activities with friends, religious participation, and voluntary group membership with cardiovascular disease risk behaviors (smoking, adequate physical activity, and adequate intake of fruits and vegetables).

Research questions:

1. Are social ties associated with positive cardiovascular disease risk behaviors among Ghanaian older adults?
2. Are there gender differences in associations of specific social ties with cardiovascular disease risk behavior?

Aim 2: To examine the association of health system responsiveness, health insurance, type of usual provider, and health care utilization with awareness of hypertension status among a nationally representative sample of Ghanaian older adults.

Research questions:

1. What health system factors are associated with awareness of hypertension status among Ghanaian older adults?
2. Are the associations different between indicators of access and a measure of health system responsiveness?

Aim 3: To examine whether a composite measure of social integration is significantly associated with proper hypertension management behaviors, and whether and how this association is different from the association of these behaviors with the individual indicators of social ties.

Research questions:

1. What are the associations between a composite measure of social integration with disease management behaviors among hypertensive Ghanaian older adults?
2. Are there significant interactions between sex and the social integration index?
3. Is there a stronger association between social integration and specific disease management behavior than between social integration and the general protective health behaviors?

Conceptual Framework

The conceptual framework (Figure 1.1) is an adaptation of an ecological model designed to explain the multiple layers of influence on health behavior [131, 132]. These influences act at the individual and interpersonal levels, as well as the larger policy and economic context. The proposed model identifies individual, interpersonal, and health system-level factors that may explain CVD risk and hypertension management behaviors among Ghanaian older adults. Solid arrows represent relationships that are tested in the analysis, while dashed arrows are associations that are not of direct interest in this analysis but are included to address potential confounding with the relationships of interest. No relationship with CVD morbidity or mortality, directly or indirectly, is assessed in this analysis.

Research methods

Overall study design

This study is a cross-sectional analysis of secondary data to describe the association of social ties with CVD risk and hypertension management behavior, as well as the important health system factors that associated with awareness of hypertension diagnostic status.

Source of data

This is a cross-sectional study using secondary data from the WHO's Study on global AGEing and adult health (SAGE). SAGE is a multi-country longitudinal survey of nationally representative samples of adults aged 50 and older which aims to collect comparable, valid, and reliable data across several domains of health and well-being. The main purpose of SAGE is to collect reliable data on health and ageing across low and middle income countries (LMIC). Household and individual level data were collected from samples in China, Ghana, India, Mexico, Russian Federation, and South Africa. The analyses being conducted involve only one wave of data from Ghana. This publicly available data was accessed through a data repository from the Interuniversity Consortium for Political and Social Research (ICPSR) at the University of Michigan.

Sampling

The data was collected from respondents who were selected for and consented to household and individual interviews. These were mostly adults age 50 and older, with a smaller cohort of adults 18 to 49 years old whose data were collected to allow for possible comparisons [130, 133]. The sample was drawn from a sampling frame developed from Ghana's 2000 Population and Housing census and updated in 2007 before the data collection commenced [133]. This was stratified into the 10 administrative regions in the country, and the sampling frame included 250 enumeration areas (EA) selected from these strata [133]. The number of EAs selected from each stratum was determined by probability proportional to size, with size being denoted by the number of EAs in each stratum. Selection of EAs within each stratum was then by probability proportional to EA size, with size being denoted by the number of 50 years and older individuals residing in an EA. In each selected EA, households were classified into one of three categories [133]:

- 1) A follow-up household from the 2003 WHO World Health Survey (WHS), also considered to be SAGE Wave 0, with one or more adults 50 years or older.
- 2) New households with at least one adult aged 50 years or older.

- 3) A SAGE Wave 0 follow-up household with no adults aged 50 or older but adults 18-49 years old.
- 4) New households with no adult 50 years or older but adults 18-49 years old.

For a target sample size of 5,000 50-plus households and 1,000 18-49 households, 24 households were to be selected in each EA, with 20 being 50-plus households [133]. All SAGE Wave 0 households (category 1) with at least one member 50 years or older were eligible for the interviews [133]. If there were not enough such households in an EA, the remaining 50-plus households were systematically selected from the list of new 50-plus households (category 2) [133]. Four SAGE Wave 0 households with adults less than 50 years old (category 4) were randomly selected [134]. All adults 50 years and older in each household were eligible to be interviewed [133, 135]. One adult from each of the four 18-49 in each EA was randomly selected to be interviewed [135]. There were 5,178 households and 5,571 individuals selected for interviews. The household and individual response rates were 97.7% and 93.8%, respectively [133]. For this study, an initial sample of 4,264 individuals aged 50 or older who completed the survey and had non-missing cluster and sample weight data were selected.

SAGE Survey Questionnaire

The SAGE survey questionnaire was adapted from the instruments and methods used in the 2003 WHO World Health Survey (WHS) and pretested in 2005 with 1500 respondents in Ghana, India, and Tanzania [136]. The questionnaire consists of the following six main instruments: household questionnaire, individual questionnaire, proxy respondent questionnaire, proxy validation questionnaire, retest questionnaire, and verbal autopsy questionnaire [133]. The proxy validation and retest questionnaires were included as quality control measures [133]. Data collection was conducted using paper and pencil during face to face interviews. If an individual selected for an interview was incapable of answering the individual questionnaire due to inability to comprehend, the interview was conducted with a family member as a proxy. There were a total of 16 proxy interviews completed [134].

Measures

For each aim, variables were constructed to assess the associations of interest. The primary outcome and independent variables are described below.

Hypertensive status

In the SAGE questionnaire, hypertensive status was assessed by either self-report or measured hypertension. For self-report, respondents were asked whether

they had ever been diagnosed with high blood pressure. Possible responses were “yes” or “no”. Blood pressure (BP) measurements were taken for all respondents who consented. This was conducted using a Boso Medistar Wrist Blood Pressure Monitor Model S [135, 136]. The device was around a respondent’s wrist, and respondent was instructed to keep his or her arm steady and at the level of the heart [135, 136]. Three blood pressure readings were conducted, with one minute of rest separating the measurements. For this study, the mean of the last two measurements was used in the classification of hypertensive status. Respondents with mean systolic blood pressure (SBP) ≥ 140 mmHg or diastolic blood pressure (DBP) ≥ 90 were classified as hypertensive, as were those who responded “yes” to the self-report question.

Awareness of hypertensive status

A dichotomous hypertensive awareness variable was created (1 = aware, 0 = unaware). Respondents whose mean BP was in the hypertensive range (SBP ≥ 140 or DBP ≥ 90) and responded “no” to the self-report question on hypertension were classified as unaware. Those who responded “yes” to the self-report question, regardless of mean BP measurement, were classified as being aware.

Medication adherence

Respondents who self-reported diagnosis of hypertension were asked whether they had taken their blood pressure lowering medication in the previous 2 weeks. Possible responses were “yes” or “no”. A response of “yes” meant the respondent had taken such medication in the past two weeks and “no” meant the respondent usually takes medication but had not done so in the past two weeks [136]. A dichotomous medication adherence variable was created (1 = took medication in past two weeks, 0 = did not take medication in past two weeks).

Tobacco use

Respondents who reported currently smoking or consuming tobacco in other form were classified as current tobacco users.

Fruit and vegetable consumption

The amount of fruit and vegetable consumption was based on responses to separate questions on the number of fruits and the number of vegetables a respondent ate in a typical day. To assist in the respondent’s comprehension, showcards of fruits and vegetables commonly consumed in each area were used. To arrive at the total servings of fruits and vegetables the respondent consumed on a typical day, the two reported values were summed. Based on WHO recommendations of consuming at least 5 servings of fruits and vegetables on a typical day as a preventive measure for CVD [137–141], a dichotomous variable

was created to indicate whether the respondent consumed adequate amounts of fruits and vegetables on a typical day (1 = 5 or more servings, 0 = less than five servings).

Physical activity

Level of physical activity was derived from a series of questions on length and intensity of physical activity. These questions were adapted from the WHO's global physical activity questionnaire (GPAQ) [142, 143]. GPAQ collects data on physical activity in three domains: activity at work, transport related physical activity, and recreational physical activity. This instrument (defining and describing the instruments and methods is a section in and of itself) has been found in several studies to be a valid and reliable measure of physical activity in disparate country and cultural settings, including in developing countries [142, 144, 145]. Responses to questions in the three domains are scored using a detailed algorithm [143].

Moderate and vigorous activity are assigned four and eight metabolic equivalents (MET), respectively. One MET is equivalent to the energy cost of sitting without any activity, or 1 kcal/kg/hour. In each domain, total MET for moderate and vigorous physical activity are calculated separately by multiplying the amount of time per week spent engaging in such activity by the base MET of

4 or 8, and then summed for the domain MET. Transport related physical activity is classified as equivalent to moderate physical activity, without further sub-domains. For each individual, scores from all three domains were summed to arrive at the total MET-minutes of moderate and vigorous physical activity per week. Using a WHO standard, MET scores were dichotomized, with weekly MET-minutes less than 600 being classified as inadequate physical activity and those greater than or equal to 600 being classified as adequate physical activity [143].

Marital status

Marital status was based on a survey question asking respondents to classify their current marital status. Possible responses included “never married”, “currently married”, “cohabiting”, “separated or divorced”, and “widowed”. This data was used in two different ways. In the descriptive tables, the responses were grouped into 3 categories: “currently married” and “cohabiting” as “married/cohabiting”, “never married” and “separated or divorced” as “never/separated/divorced”, and “widowed”. When used as a social tie in Paper 1 and Paper 3, marital status was dichotomized, coded 1 for “married” or “cohabiting” and 0 for other non-missing response categories.

Religious attendance

Respondents were asked to report how often they attended church or other religious services. Possible responses included “never”, “1 to 2 times per year”, “1 to 2 times per month”, “1 to 2 times per week”, and “daily”. Preliminary exploration of the variable indicated that 51% of respondents attended religious services “1 or 2 times per week” and 13% attended religious services “daily”. This response was dichotomized to indicate whether or not respondent attended religious services regularly (1 = regular attendance, 0 = not regular attendance). Regular attendance was classified as attending religious services “1 or 2 times per week” or “daily”.

Socially active

Respondents were asked three questions about how often friends visited their homes, they visited others’ homes, and socialized with coworkers outside of work. We created a new dichotomous “socially active” variable. This variable was coded 1 for responses of “daily” on at least one of the three questions or “1-2 times per week” on all three questions. Otherwise, the “socially active” variable was coded 0. The SAGE survey did not include a clear question about contact with family members so information from such contacts was not included.

Group membership

Respondents were asked how often they attended any group, club, or other voluntary organization meeting. Possible responses included “never”, “1 to 2 times per year”, “1 to 2 times per month”, “1 to 2 times per week”, and “daily”. Those who attended at least monthly were considered to be regular attenders and classified as belonging to a group. A dichotomous group membership variable was created, coded as “1” for regular attendance and “0” otherwise.

Berkman-Syme Social Network Index

Berkman and Syme’s social network index (SNI) is a summary measure of the number of social relationships and contacts that an individual has on a regular basis [46]. Berkman and Syme developed and used this index in the Alameda county study on the association of social relationships with mortality [46]. The index has been used in several subsequent studies [36, 47, 48, 55, 82, 84, 146, 147]. The SNI was constructed using responses to questions in four areas of social ties: marital status, religious participation, participation in activities with friends and coworkers (socially active), and group membership. Dichotomized variables were created for each indicator of social ties (previously described). The sum of the dichotomized responses was used to create levels for the SNI.

Respondents with 0 to 1 significant ties were categorized into level I, while those with 2, 3, or 4 significant ties were categorized in levels II, III, and IV, respectively. This categorization follows similar practices utilized in previous studies [46, 82, 84, 148, 149].

Health system responsiveness

Health system responsiveness was derived from responses to 7 domains of questions about the most recent outpatient encounter with the health system. Respondents were asked to rate their experiences in the following areas: waiting time, respectful treatment, clear communication by provider, involvement in decision-making, privacy, choice of provider, and cleanliness of health facility. Possible responses were “very good”, “good”, “moderate”, “bad”, and “very bad”, with numerical values of 1, 2, 3, 4, and 5, respectively. These were reverse coded and rescaled from 0 to 4, such that 0 corresponded with a rating of “very bad” and 4 corresponded with a rating of “very good”. A summary score for responsiveness was obtained using principal components analysis (PCA) and then scaled from 0 to 100, with 0 indicating least responsive and 100 indicating most responsive [134].

Health insurance

Health insurance status was derived from response provided by head of household to a question of whether the respondent had health insurance. A dichotomous insurance variable was coded 1 for responses indicating that the respondent had mandatory insurance, voluntary insurance, or both. Otherwise, the variable was coded as 0.

Frequency of outpatient visits

Respondents were asked how many outpatient visits they made in the past 12 months.

Type of provider last seen

Respondents who reported having visited or consulted with a health care provider in the past 12 months were asked about the type of provider seen. Possible responses were “medical doctor”, “nurse or midwife”, “traditional healer”, “pharmacist”, “dentist”, “physiotherapist”, and “home health care worker”. The latter 3 categories were reclassified as “other” for the regression analyses as they contained very few responses.

Analysis strategy

To model the relative risk of each health behavior and awareness outcome, Poisson regression analysis with robust standard errors was conducted [150–153], relating each outcome separately with the relevant sets of individual, interpersonal, and health system variables. Each regression model was adjusted for sociodemographic characteristics, as well as theoretically relevant covariates that may confound or mediate the associations of interest. To assess multicollinearity, variance inflation factors (VIF) were calculated for the sets of covariates in the final regression models. Covariates with $VIF \geq 10$ are generally considered undesirable in regression models, and will be dropped from final models if they are collinear with the social ties of interest [154–156].

Dissertation organization

The dissertation is organized into five chapters. In Chapter 1, background on the research question, the source of data, and the conceptual framework is reviewed.

Chapter 2 uses data from Wave 1 of the WHO's Study of AGEing and adult health (SAGE) collected in Ghana to assess the association of different social ties with cardiovascular disease risk behaviors among adults 50 years and older, and whether these associations are different among men and women.

Chapter 3 uses Ghana SAGE data but only the sample of self-reported and measured hypertensive adults age 50 years and older to assess the associations between health systems factors and awareness of hypertensive status.

Chapter 4 also uses Ghana SAGE data but of only adults age 50 and older who self-report being diagnosed with hypertension. This data is used to assess the associations of a composite measure of social integration with hypertension management behaviors, if and how these associations are different between men and women, and whether the composite measure is better associated with disease management behaviors among those who are hypertensive or preventive behaviors within the sample of older adults.

Chapter 5 concludes the dissertation, summarizing the results from chapters 2 to 4 and comparing to results of previously published studies. Finally, policy implications and avenues for future research are discussed.

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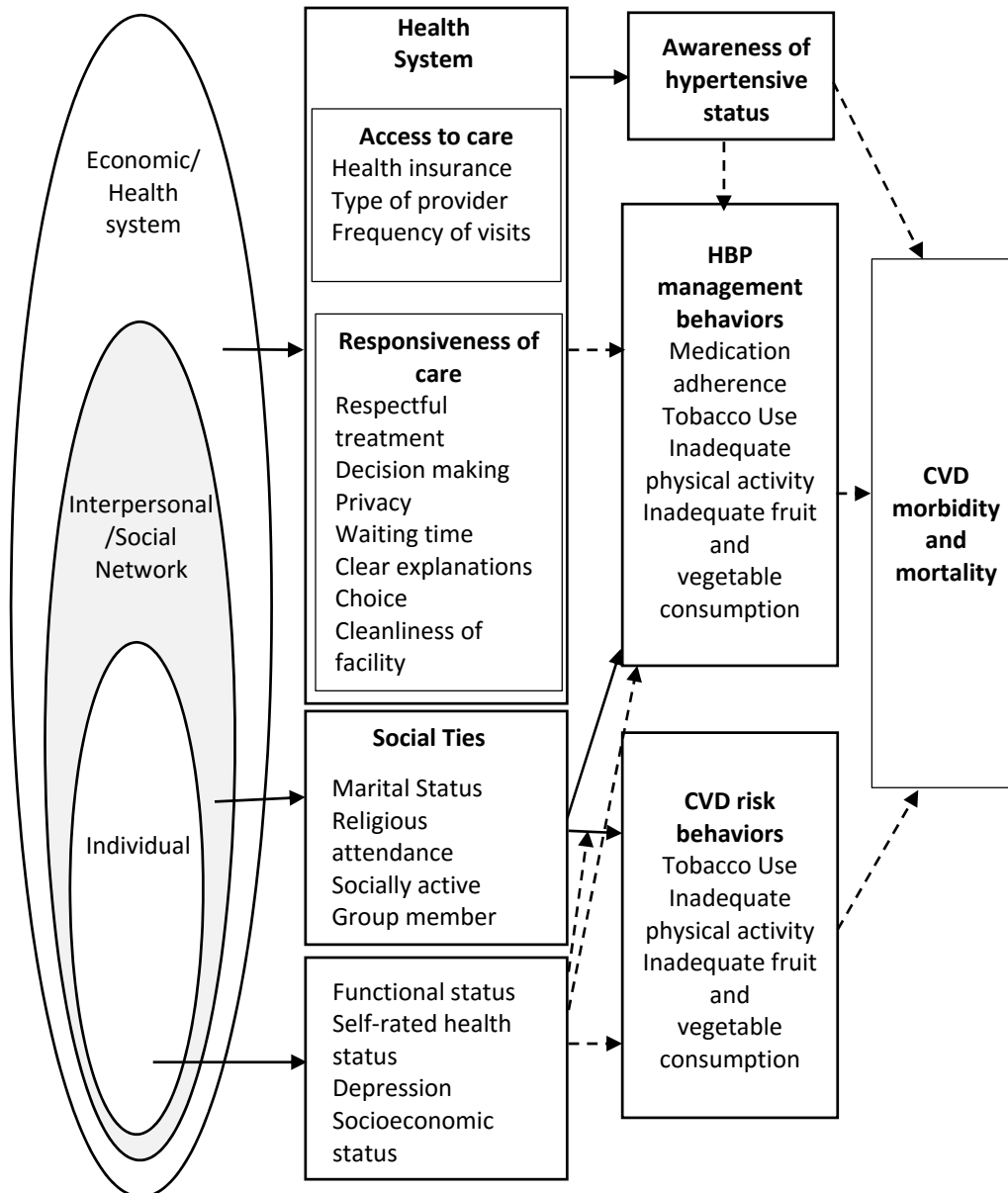
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Figure 1.1: Social Integration and health behavior framework



Adapted from Sallis, J. F., Owen, N., & Fisher, E. B. (2008). *Ecological Models of Health Behavior*. In *Health Behavior and Health Education: Theory, Research, and Practice* (pp. 465–485)

Chapter 2: Paper 1

Title: Social ties and cardiovascular risk behavior among Ghanaian older adults

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Abstract

Purpose:

Social relationships have been found to have significant associations with health behaviors in numerous studies, although much of the evidence stems from studies conducted in developed country contexts. This study examines the association of different social relationships with cardiovascular risk behavior among a nationally representative sample of Ghanaian older adults, and whether these associations differed by gender.

Methods:

Data from Ghana Wave 1 dataset of the WHO Study on global AGEing and adult health (SAGE), a multi-country longitudinal survey of older adult well-being and health. Physical activity was measured using the GPAQ instrument, tobacco use was based on response to a question on current use of any tobacco products, and fruit and vegetable intake was based on responses to two separate questions regarding servings of fruits and vegetables consumed in a typical day. Social ties included dichotomized variables of marital status, regular attendance at religious services, regular attendance at voluntary group meetings, and frequent socialization with friends and coworkers. The association between each CVD risk behavior and the social ties were assessed in separate robust Poisson regressions adjusted for sociodemographic covariates, and then mutually adjusted for other social ties.

Results:

Compared with the women, men were more likely to be married or cohabiting (85.1% vs 30.9%), be members of voluntary groups (46.2% vs 40.8%), and be more socially active (42.4% vs 38.7%), while women were more likely to be widowed (48.4% vs 6.5%). Men were also more likely to use tobacco (15.6% vs 5.4%) and to have adequate levels of physical activity (80.5% vs 73.6%).

Tobacco use was significantly less likely among men who regularly attended religious services (adjusted PR 0.69; 95% CI 0.54 – 0.87). Among both men and women, religious attendance, group membership, and being socially active were positively associated with an increased likelihood of adequate physical activity. Religious attendance was positively associated with consuming adequate amounts of fruits and vegetables among both groups. Group membership had a negative association with consuming adequate amounts of fruits and vegetables (PR 0.65 for men, PR 0.57 for women). Socially active women were at significantly higher risk of prevalent tobacco use (PR 1.69; 95% CI 1.04 – 2.74). Marital status had no significant associations with any risk behavior.

Conclusions:

There was evidence of associations between different social ties and cardiovascular risk behaviors, and they may differ between men and women of a nationally representative cohort of older Ghanaian adults.

Introduction

During the past century, industrialized nations underwent remarkable improvements in the quality of life as a result of advances in medicine, technology, and economic development [1–3]. In developing countries, significant reductions in nutritional deficiencies, improvements in the prevention and treatment of infectious diseases, and significant investments in public health programs have led to declines in fertility and increased life expectancy [3–7]. However, these countries continue to experience high burdens of infectious diseases [8–10]. The improvements in health, life expectancy, and economic well-being have also contributed to increases in the burden non-communicable diseases (NCDs) such as cardiovascular disease (CVD), cancer, and diabetes [7, 11, 12].

Increasing proportions of older adults and harmful life style behaviors have contributed to a shift in the pattern of disease burden across the globe [4, 13–15]. NCDs have now become major disease burdens, accounting for 65% of mortality and 54% of disability adjusted life years (DALY) lost in 2010 [16–18]. Nearly 80% of the global NCD burden is in low and middle income countries (LMIC) [18, 19], a result of rapid aging of the populations, urbanization, and increasing risk behaviors in LMIC [14, 20–23]. There are enormous health and economic impacts from this burden [24–29]. Already taxed with addressing the

continuing burden of infectious diseases, health systems in developing countries are challenged to address the growing burden of NCDs [10, 30–32].

Furthermore, current systems of care are designed to address the acute and episodic nature of most infectious conditions, whereas NCDs require a continuity of care in which the patient and their social relations play a vital role [32].

Cardiovascular disease is the leading cause of mortality globally, with 80% of CVD deaths occurring in LMIC [21, 33]. This burden is expected to increase as the socio-economic conditions of countries improve and the proportion of older adults increase [21]. Several modifiable risk behaviors have been found to be important in the development of CVD. Tobacco use, including occasional smoking, has been associated with the incidence of CVD [34–37], as have lack of adequate physical activity [38–40] and diets low in fruits and vegetables [41–44].

A significant body of research has shown that the social environment and social relationships play important roles in disease incidence, severity and mortality [45–49]. Social relationships may impact health and mortality through its influence on risk behaviors such as smoking, diet, and physical exercise [50–54]. An individual's social network may work as supports for dealing with health problems, as well as sources of social control by imposing norms for

expected health promoting, as well as health compromising, behaviors [51, 55, 56].

Four types of social ties are commonly assessed for their impact on health and health behavior: marital status, religious participation, engagement in social activities with relatives and close friends, and participation in voluntary organizations or clubs [47, 57–60]. Associations between these ties and the risk behaviors have been variously studied. Being married has been associated with reduced incidence of and mortality from disease [60–63] and higher reported levels of psychological well-being [64, 65, 62]. Members of a person's social network with very close ties, such as spouses, can exercise greater social control of the health behaviors, and are most likely to provide specific social support [55, 66]. Umberson notes that the effect of marital status on health promoting behavior is greater for men than women, due largely to established gender roles in which women are more likely to be monitoring the health and well-being of other family members [66].

Religious attendance has been associated with mortality and morbidity from chronic conditions [67]. A possible explanation is that certain religious traditions may mandate healthy behaviors such as abstention from alcohol and tobacco use, as well as reverence for the physical body and adherence to medical treatments [68]. Religious attendance may also provide a larger network of

social support, and thus helpful for countering the effects of stressful life events [69, 68, 70]. This network may also be a source of health information and guidance for dealing with the emotional and physical toll of diseases [67]. Likewise, participation in voluntary groups and frequently socializing with friends fosters a sense of belonging in and attachment to a community, and may obligate certain norms of health behavior [51].

While there has been considerable evidence of the associations of social relationships with health and mortality, much of the evidence stems from studies conducted in developed countries. Few studies have examined the role of social relationships in CVD risk behaviors such as smoking, inadequate fruit and vegetable consumption, and inadequate physical activity among older adults in LMIC [18]. Ghana is an LMIC experiencing increasing economic and social development, urbanization and changing dynamics of social relationships. This study seeks to test the associations between these social ties and specific CVD risk behaviors among a nationally representative sample of older Ghanaian adults.

Methods

Study population

For this analysis, a subset of data collected in Ghana for Wave 1 of the WHO Study on Global Ageing and Adult Health (SAGE). SAGE is a multi-country longitudinal survey of nationally representative samples of adults aged 50 and older which aims to collect comparable, valid, and reliable data across several domains of health and well-being. Household and individual level data were collected from samples in China, Ghana, India, Mexico, Russian Federation, and South Africa. The analyses being conducted involve only one wave of data from Ghana. This publicly available data was accessed through a data repository from the Interuniversity Consortium for Political and Social Research (ICPSR) at the University of Michigan.

The sample was drawn from a sampling frame developed from Ghana's 2000 Population and Housing census and updated in 2007 before the data collection commenced [71]. This was stratified into the 10 administrative regions in the country, and the sampling frame included 250 enumeration areas (EA) selected from these strata [71]. The number of EAs selected from each stratum was determined by probability proportional to size, with size being denoted by the number of EAs in each stratum. Selection of EAs within each stratum was then by probability proportional to EA size, with size being denoted by the

number of 50 years and older individuals residing in an EA. In each selected EA, households were classified into one of three categories [71]:

- 1) A follow-up household from the 2003 WHO World Health Survey (WHS), also considered to be SAGE Wave 0, with one or more adults 50 years or older.
- 2) New households with at least one adult aged 50 years or older.
- 3) A SAGE Wave 0 follow-up household with no adults aged 50 or older but adults 18-49 years old.
- 4) New households with no adult 50 years or older but adults 18-49 years old.

For a target sample size of 5,000 50-plus households and 1,000 18-49 households, 24 households were to be selected in each EA, with 20 being 50-plus households [71]. All SAGE Wave 0 households (category 1) with at least one member 50 years or older were eligible for the interviews [71]. If there were not enough such households in an EA, the remaining 50-plus households were systematically selected from the list of new 50-plus households (category 2) [71]. Four SAGE Wave 0 households with adults less than 50 years old (category 4) were randomly selected [72]. All adults 50 years and older in each household were eligible to be interviewed [71, 73]. One adult from each of the four 18-49 in each EA was randomly selected to be interviewed [73]. There were 5,178 households

and 5,571 individuals selected for interviews. The household and individual response rates were 97.7% and 93.8%, respectively [71]. For this study, sample of 4,264 individuals aged 50 or older who completed the survey and had non-missing cluster and sample weight data were selected.

Data collection

The SAGE survey questionnaire was adapted from the instruments and methods used in the 2003 WHO World Health Survey (WHS) and pretested in 2005 with 1500 respondents in Ghana, India, and Tanzania [74]. The questionnaire consists of the following six main instruments: household questionnaire, individual questionnaire, proxy respondent questionnaire, proxy validation questionnaire, retest questionnaire, and verbal autopsy questionnaire [71]. The proxy validation and retest questionnaires were included as quality control measures [71].

Interviewers were trained and supervised during data collection. Data collection was conducted using paper and pencil during face to face interviews. If an individual selected for an interview was incapable of answering the individual questionnaire due to inability to comprehend, the interview was conducted with a family member as a proxy. There were a total of 16 proxy interviews completed [72].

Measures

Main independent variables

We measured social ties according to a respondent's responses to questions in four areas: whether or not the respondent was married, attended religious services regularly, was a member of a club or voluntary organization, and had regular contacts with friends. In the survey questionnaire, marital status responses were categorized as "never married", "currently married", "cohabiting", "separated or divorced", and "widowed". A new binary marital status variable was created (1 = currently married/cohabiting, 0 = never married/separated/divorced/widowed). Questions on frequency of religious attendance, attendance at club or group meetings, and socializing with friends and coworkers had the following response categories: "1-2 times per year", "1-2 times per month", "1-2 times per week", "daily", and "never". Exploration of the religious attendance variable revealed that more than half of respondents attended religious services 1-2 times per week. A dichotomous religious attendance variable was created, with those indicating at least once weekly attendance being coded as 1 and those attending less than once per week being coded as 0. A new group participation variable was coded 1 for those who attended group and club meetings at least monthly, and those who attended less frequently were coded 0.

Respondents were asked three questions about how often friends visited their homes, they visited others' homes, and socialized with coworkers outside of work. We created a new dichotomous "socially active" variable. This variable was coded 1 for responses of "daily" on at least one of the three questions or "1-2 times per week" on all three questions. Otherwise, the "socially active" variable was coded 0. The SAGE survey did not include a clear question about contact with family members so we did not include information on such contacts.

Dependent variables

Risk behaviors associated with cardiovascular disease and hypertension were used as dependent variables in separate analyses. These include current tobacco use, level of physical activity, and vegetable and fruit intake. Current tobacco use was derived from a survey question which asked respondents whether they currently use any tobacco products. Those responding "yes" were classified as current tobacco users.

Level of physical activity was derived from a series of questions on length and intensity of physical activity. These questions were adapted from the WHO's global physical activity questionnaire (GPAQ) [75, 76]. GPAQ collects data on physical activity in three domains: activity at work, transport related physical activity, and recreational physical activity. This instrument has been found in several studies to be a valid and reliable measure of physical activity in

disparate country and cultural settings, including in developing countries [75, 77, 78]. Responses to questions in the three domains are scored using a detailed algorithm [76].

In summary, moderate and vigorous activity are assigned four and eight metabolic equivalents (MET), respectively. One MET is equivalent to the energy cost of sitting without any activity, or 1 kcal/kg/hour. In each domain, total MET for moderate and vigorous physical activity are calculated separately by multiplying the amount of time per week spent engaging in such activity by the base MET of 4 or 8, and then summed for the domain MET. Transport related physical activity is classified as equivalent to moderate physical activity, without further sub-domains. For each individual, scores from all three domains were summed to arrive at the total MET-minutes of moderate and vigorous physical activity per week. Using a WHO standard, MET scores were dichotomized, with weekly MET-minutes less than 600 being classified as inadequate physical activity and those greater than or equal to 600 being classified as adequate physical activity [76].

Amount of fruit and vegetable intake was derived from responses to two questions: (1) the number of servings of fruit consumed on a typical day, and (2) the number of servings of vegetables consumed on a typical day. Valid responses to these two questions were summed to arrive at a combined value for

both fruit and vegetable intake. Using the WHO recommendation, a dichotomous variable was created for adequate fruit and vegetable intake, with less than 5 servings being classified as inadequate.

Covariates

Regression models were stratified on sex and controlled for the following demographic characteristics: age, permanent income quintile, education, employment, ethnicity, and residence. Permanent income quintile was already derived and included in the SAGE dataset, with the first quintile being poorest and the fifth quintile being wealthiest. The derivation of permanent income values from asset, household characteristic, and access to services data in the SAGE survey are described elsewhere [73, 71, 79]. The following categorical age bands were created from the continuous age variable: 50 to 59 years, 60 to 69 years, 70 to 79 years, and 80 plus. Educational status was assessed based on responses to a question on a respondent's highest level of education completed. For this analysis, responses were collapsed into the following categories: "no formal education", "primary or less", "completed junior high", and "secondary school or higher".

Employment status was categorized as agricultural, non-agricultural, or unemployed. Ethnicity was grouped into the following five categories: Akan,

Ewe, Ga-Adangbe, Northern groups, and other. Urban residence was dichotomized (0 = false, 1 = true).

Risk factors and health conditions that may confound or mediate the relationships of interest were also included in the analysis. These included the number of other chronic conditions that may require ongoing treatment, self-rated health status, alcohol use, overweight status, and level of functional ability or disability.

The chronic conditions included in the analysis were diabetes, arthritis, stroke, angina, chronic lung disease, asthma, cataracts, and loss of all teeth. In the survey, respondents were asked if they had been diagnosed by a medical professional with each of the chronic conditions. For this analysis, responses were coded as 1 = self-report of being diagnosed with the condition and 0 = self-report of never being diagnosed with the condition. A new categorical variable was derived comprising the number of these conditions a respondent self-reported, with the following possible values: “None”, “One”, “Two or more”.

Self-rated health status was derived based on response to the following survey question: “in general, how would you rate your health today?”. Possible responses were “very good”, “good”, “moderate”, “bad”, and “very bad”. A trichotomized health status variable was derived, with “very good” and “good” responses categorized as “good”, “bad” and “very bad” categorized as “poor”,

and “moderate” remained unchanged. A dichotomous alcohol variable categorized respondent’s response to a question on drinking alcohol in the past 30 days (1 = yes, 0 = no).

Overweight status was derived from categorizations of body mass index (BMI) based on WHO guidelines. First, a continuous BMI variable was derived from measured height and weight. BMI was then calculated as weight in kilograms divided by the square of the measured height in meters. Using WHO recommendations, BMI was categorized as follows: underweight ≤ 18.4 kg/m²; normal 18.5 kg/m² – 24.9 kg/m²; overweight 25.0 kg/m² – 29.9 kg/m²; obese ≥ 30.0 kg/m². Thus, the dichotomous overweight variable was coded 1 if BMI ≥ 25 kg/m² and 0 otherwise.

Functional ability was assessed based on the 12-item WHO disability assessment schedule, version 2 (WHODAS-II). These items were included as part of the SAGE questionnaire. WHODAS-II provides a generic instrument used to capture the level of health and functioning in the following six domains: (1) cognition, (2) mobility, (3) self-care, (4) getting along with others, (5) life activities such as domestic duties, school, leisure, and work, and (6) participation in the community and the society. Each domain was evaluated using two questions regarding level of difficulty in functioning in the previous 30 days. Possible responses were “none”, “mild”, “moderate”, “severe”, and “extreme –

cannot do". A summary score for all six domains was transformed onto a 0-100 scale to arrive at the WHODAS score, with higher scores indicating greater levels of difficulty in functioning. This was inverted to create a new WHODASi, such that a score of 100 indicated greatest functional ability while a score of 0 indicated least functional ability [80, 81]. A dichotomous WHODASi variable was created for use in the regression models, indicating whether or not a respondent's score was at or above the median WHODASi score for the population of older adults in the sample (1 = yes, 0 = no).

Statistical analysis

Initial descriptive statistics were computed for the analysis sample. Adjusted Wald χ^2 tests of association were conducted for the relationship between each indicator of social ties and each nominal covariate. The prevalence ratio (PR) associations between social ties and hypertension risk behaviors were modeled using design-based Poisson regression models with robust standard errors [82–85]. While the binary nature of the outcomes would generally be suited for binomial regression, odds ratios obtained from logistic models are known to exaggerate the relative risk estimates for outcomes that are common [86]. Log-binomial models would permit direct estimates of relative risk, yet there are issues with such models failing to converge, a situation which arose in

the current analyses. Following the recommendations of Blizzard & Hosmer [84], Barros & Hiraakata [82], Zou [83], and Chen et al [85], the Poisson regression model was chosen, and robust standard errors were estimated to account for violation of the distributional assumptions for the variance in a Poisson model and the clustering of observations in the complex survey.

Previous studies found that the association of social ties with health behaviors and mortality outcomes can differ by gender [60, 63, 66]. We therefore stratified the analyses by gender. All regression analyses were performed using R version 3.2 and the R “survey” package [87]. Regression models were built in a stepwise fashion. For each outcome, four multivariable Poisson models were fitted. The first model (Model 1) is an age adjusted model, regressing each outcome separately on each indicator of social ties (marital status, religious attendance, socially active, and group membership) and categorical age variable. The second model (Model 2) additionally adjusted Model 1 for the following sociodemographic covariates: wealth quintile, education, employment, ethnicity, and urban residence. The third model (Model 3) additionally adjusted Model 2 for overweight/obese status and alcohol use. Model 4 additionally adjusted for poor health status, number of chronic conditions, WHODASi score. Wald χ^2 tests were conducted to assess the overall significance of categorical covariates. To assess multi-collinearity, variance inflation factors (VIF) were calculated.

Covariates with $VIF \geq 10$ are generally considered undesirable in regression models, and will be dropped from final models if their inclusion significantly affects confidence intervals for the social ties of interest [88, 89].

Results

Sample characteristics

Table 2.1 provides a summary of the sociodemographic and health characteristics of the study sample. The sample consisted of 4,264 respondents, with 48% being women. Nearly half of the sample identify as Akan ethnicity, while Ewe, Ga-Adangbe, and a combination of Northern ethnic groups represented 7.3%, 10.6%, and 12.1%, respectively. A combination of other smaller ethnic groups represented 21.4% of the sample.

There were no significant differences in median age between men and women. Overall, more men than women had higher levels of education, in higher wealth quintiles, and were employed. Significantly more women than men had no formal education (65.5% vs 43.3%) and a greater percentage of men than women completed at least junior high school (34% vs 14.5%). While approximately 46% of men were in the top two income quintiles, only 37% of women were so categorized.

Women had higher median BMI than men, and more women than men were overweight or obese (35.8% vs 25.1%). A greater percentage of men than women had at least one chronic condition (39.8% vs 31.6%), but more men reported having “good” or “very good” health and had higher median function scores (WHODASi). Alcohol consumption was much more prevalent among men (41.8% vs 18.8%). Both men and women had low levels of adequate fruit and vegetable consumption. More men than women had adequate levels of physical activity and used tobacco.

There were dramatic differences in the distribution of marital status among men and women. While 85.1% of men reported being married or cohabiting, only 30.9% of women reported the same. Additionally, 48.5% of women reported as being widowed, compared with only 6.6% of men. More men than women were members of voluntary groups or clubs (46.2% vs. 40.8%) and engaged in more social interactions with friends and coworkers (42.4% vs. 38.7%). There was no significant difference between men and women with regards to attending religious services at least once per week.

Bivariate associations with social ties

In bivariate analyses, the four indicators of social ties were found to be associated with several sociodemographic, health, and health behavior variables.

Table 2.2 provides results of these analyses for the subsample of men. Among men, a greater percentage of those who were married had higher levels education, were in higher wealth quintiles, and were employed. They were also less likely to report poor health, more likely to have adequate levels of physical activity, and yet more likely to be overweight or obese. Regular religious attendance was likewise positively associated with higher wealth quintiles and being employed, as well as with urban residence, being overweight or obese, and having one or more chronic conditions. It was negatively associated with reporting poor health, current tobacco use, and having adequate consumption of fruits and vegetables. Men who were socially active were less likely to be in the top wealth quintiles, yet much more likely to be employed and less likely to report poor health or be urban residents. Being a group member was positively associated with younger age, having some formal education, being in higher wealth quintiles, being employed, and having one or more chronic conditions. Group members were less likely to report poor health, use tobacco, or consume adequate fruits and vegetables.

There were similar bivariate associations among women (Table 2.3). Among women, being married was positively associated with having some education, being in higher wealth quintiles, being employed, having fewer chronic conditions, and having adequate levels of physical activity. Married

women were also more likely than widows to be overweight or obese (37.6% vs 32.5%), but less so than those who were otherwise single (40.3%). However, married men were much more likely to be overweight or obese than either widowed or single men (27%, 16.8%, 14% respectively). Similar to men, women with regular religious attendance were more likely to be in higher wealth quintiles and be employed, as well as being more likely to have some formal education. Unlike men, they were just as likely to be urban residents as they were to be rural residents.

Among women, religious attendance was positively associated with being overweight or obese, having adequate levels of physical activity, and consuming adequate amounts of fruits and vegetables, but negatively associated with reporting poor health, current alcohol use, and current tobacco use.

Being socially active was associated with higher wealth quintiles and having some formal education, although these associations were weaker than those of these socioeconomic indicators with marital status and religious attendance. Women who were socially active were more likely to be employed, have adequate levels of physical activity, and adequate fruit and vegetable consumption. Like men, socially active women were less likely to be urban residents, report poor health, or drink alcohol.

Women who were group members tended to have some formal education, be in higher wealth quintiles, and be employed. They were less likely to report poor health and have adequate levels of physical activity, yet more likely to be overweight or obese, and not consume adequate amounts of fruits and vegetables.

Adjusted prevalence ratio associations

Current tobacco use

In a Poisson model regressing each CVD risk behavior outcome separately on each of the four indicators of social ties and adjusting only for age (Model 1), religious attendance and group membership were significantly associated with reduced risk of prevalent tobacco use (PR 0.46, 95% CI 0.36-0.59 and PR 0.74, 95% CI 0.59-0.93 respectively) among men. Among women, religious attendance reduced the risk of prevalent tobacco use by 51% (PR 0.49, 95% CI 0.32-0.76). Among both men and women, only religious attendance remained statistically significantly associated with reduced risk of prevalent tobacco use after further adjusting Model 1 for other sociodemographic characteristics (education, employment, wealth quintile, urban residence, and age) (Model 2). In Model 3, further adjustments were made for other health risk behaviors (overweight and alcohol use). Religious attendance remained significant, but only marginally so

for women (PR 0.68, 95% CI 0.46-0.99). After additionally adjusting for health conditions and functional rating (health status, number of chronic conditions, and WHODASi), men who regularly attended religious services had a 29% reduced risk of prevalent tobacco use. None of the indicators of social ties remained significantly associated with tobacco use among women.

In the regression models for women, education, wealth quintile, and ethnicity were collinear in their associations ($VIF > 10$). However, each of the indicators of social ties had VIF values well-below 10. Removing wealth quintile and ethnicity variables eliminated the multicollinearity. These changes had little impact on the coefficient and confidence interval estimates for the indicators of social ties and did not improve the model fit. Therefore, the wealth quintile and ethnicity variables were added back into the final model.

Adequate physical activity

Among both men and women, the age-only adjusted model indicated that regular religious attendance, being socially active, and group membership were all positively associated with an increased likelihood of adequate physical activity. These associations remained significant after subsequent adjustments in Models 2, 3, and 4. In the final model, regular religious attendance (PR 1.12, 95% CI 1.06 - 1.19), being socially active (PR 1.1, 95% CI 1.04 - 1.16), and being a group

member (PR 1.11, 95% CI 1.06 - 1.17) were each associated with increased likelihood of adequate physical activity among men. These associations were higher among women, with religious attendance (PR 1.16, 95% CI 1.09 – 1.23), being socially active (PR 1.23, 95% CI 1.16 – 1.31), and group membership (PR 1.16, 95% CI 1.1 – 1.22) each increasing the likelihood of having adequate levels of physical activity.

Adequate fruit and vegetable consumption

Among men, an age-only adjusted model showed a negative association between group membership and the likelihood of having adequate levels of fruit and vegetable intake (PR 0.71, 95% CI 0.58 – 0.87). This association remained significant after adjusting for socio-demographics, other risk behaviors, and health and functional status (Model 4). In the fully adjusted model, group membership was associated with a 31% decreased likelihood of adequate fruit and vegetable consumption among men (PR 0.69, 95% CI 0.57 – 0.83).

There were more associations of social ties with fruit and vegetable consumption among women. In the initial model, religious attendance (PR 1.22, 95% CI 1.02 – 1.45) and being socially active (PR 1.27, 95% CI 1.06 – 1.51) were associated with an increased likelihood of adequate fruit and vegetable consumption among women. As with men, group membership showed a

negative association with the likelihood of adequate fruit and vegetable consumption (PR 0.63, 95% CI 0.52 – 0.77). These associations remained significant and the final model (Model 4). Religious attendance and being socially active increased the likelihood of adequate fruit and vegetable consumption by 24% (95% CI 3% - 50%) and 31% (9% - 57%) respectively, whereas group membership decreased such a likelihood by 39% (95% CI 25% - 50%).

Mutually adjusted models

To examine the association of each social tie when controlling for other social relationships, a model adjusting for all sociodemographic, other risk behavior, health and functional status covariates (Model 4), and all social ties concurrently was evaluated for each risk behavior. The results of the Poisson regressions are summarized in Table 2.5. Among both men and women, the associations found to be significant in Model 4 were also significant in this mutually adjusted model. However, while religious attendance was not significantly associated with fruit and vegetable consumption among men in Model 4, the association becomes significant in the mutually adjusted model (PR 1.25, 95% CI 1.02 – 1.53). Among women, there was a significant shift in the association between being socially active and tobacco use. When controlling for

other indicators of social ties, women who were socially active were 69% more likely to be current tobacco users when compared with less socially active women (PR 1.69, 95% CI 1.04 – 2.74).

Discussion

While many prior studies have examined the associations between social ties and cardiovascular disease risk behaviors, this is the first study to examine the associations of each social tie with specific cardiovascular disease risk behaviors in a nationally representative sample of older adults in Ghana. The results from this study indicate that some social ties are significantly associated with CVD risk behaviors among both men and women.

Marital status was not found to be associated with any of the risk behaviors, although prior studies have found that marriage had a protective effect against negative health behaviors [90–92]. While men were significantly more likely to be married than women, and prior studies having found marriage to have a positive effect on health behavior for men [66], no such effect was found in this study.

Religious attendance had a consistently protective association with all risk behaviors among men, and for physical activity and adequate fruit and vegetable consumption among women. This is consistent with evidence that the protective

effect of regular religious attendance and spirituality may partly be due to its promotion of a healthy lifestyle [93]. In Ghana, religious spaces such as churches and mosques are important avenues for health communication [94, 95]. Thus, not only may particular religious tenets dictate healthful behavior [68], such spaces may also be important sources of information on disease prevention and health promoting behavior.

Being socially active was a protective factor for having adequate levels of physical activity among both men and women, although this was only marginally significant for men. A study of American older adults similarly found that those with larger friendship networks were more likely to engage in physical activity [92]. Furthermore, being socially active increased the likelihood of consuming adequate fruits and vegetables by 36% among women, although this relationship was not significant for men. Among both men and women, being a group member was also positively associated with adequate levels of physical activity. These were consistent with findings from an earlier study of the association of individual and organizational relationships with cardiovascular disease risk behaviors [53].

There was evidence that some social ties may not always be health promoting. Among both men and women, membership in a group or club substantially decreased the likely prevalence of adequate fruit and vegetable

consumption. Among women, being socially active significantly increased the risk of prevalent tobacco use by 69%. Social influence is a theorized mechanism through which social ties may affect health behavior [51, 55]. It is possible that within these voluntary groups, most people are more likely to consume foods other than fruits and vegetables. Likewise, the women may be socializing with friends who tend to smoke and may not be discouraged from engaging in such behavior.

The magnitude of the significant associations was consistently stronger and further from the null for women, but these associations were in the same direction for both men and women. The results also indicate that in some instances, the pattern of associations were different between men and women. Between a model considering each social tie separately and one mutually adjusting for other social ties, the significance and magnitude of the regression coefficients for the social ties were minimally changed. This may indicate that these social ties may influence health behavior through distinct pathways.

There are several limitations with the current study. Firstly, this study was based on cross-sectional data. Therefore, there is no determination of temporal or causal associations between the social ties and health behaviors, and it is plausible that causality may be in the opposite direction to what is hypothesized [92, 96]. The strength of the SAGE study is its longitudinal design, and as data

from future waves become available, questions of temporality and causality can further be examined. Older adults are most likely to experience changes in their social networks, and similar to studies in more developed countries, it would be important to assess how these changes may impact health behavior. Ultimately, examining prospectively the relationship between changes in social ties, changes in health behavior, and CVD mortality will help elucidate the theorized pathway between social ties and mortality.

The assessed risk behaviors were based on self-report, and likely subject to reporting bias. However, information on physical activity was collected using the global physical activity questionnaire (GPAQ), a tool that has been validated and found reliable in studies across different countries [75, 78]. It is possible that using different cutoffs for the dichotomized social ties may produce different associations. While the regression models were adjusted for sociodemographic and other covariates, there is still a possibility of residual confounding.

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Table 2.1: Sociodemographic and health characteristics of study sample				
	Overall (n=4264)	Men (n = 2229)	Women (n=2035)	p-value*
Median age (IQR)	62.0 (17)	62.0 (17)	63.0 (17)	0.848
Age category, n (%)				0.485
50 to 59	1677 (39.9)	940 (40.6)	737 (39.1)	
60 to 69	1192 (27.5)	652 (27.0)	540 (27.9)	
70 to 79	969 (22.9)	434 (22.1)	535 (23.9)	
80+	426 (9.7)	203 (10.3)	223 (9.1)	
Education, n (%)				< 0.0001
No formal education	2331 (53.9)	985 (43.3)	1346 (65.5)	
Less than primary	424 (10.3)	224 (10.1)	200 (10.6)	
Completed primary	462 (11.0)	272 (12.4)	190 (9.5)	
Completed jr. high	702 (17.2)	489 (23.4)	213 (10.4)	
Completed secondary	173 (4.1)	133 (5.8)	40 (2.1)	
University or higher	143 (3.5)	105 (4.9)	38 (2.0)	
Income quintile, n (%)				< 0.0001
First (poorest)	847 (18.3)	426 (16.5)	421 (20.2)	
Second	844 (19.1)	405 (17.1)	439 (21.3)	
Third	847 (20.5)	435 (19.7)	412 (21.4)	
Fourth	864 (20.7)	457 (21.4)	407 (19.8)	
Fifth (wealthiest)	854 (21.4)	503 (25.2)	351 (17.3)	
Employment, n (%)				< 0.0001
Agricultural	1825 (43.7)	1124 (50.1)	701 (36.7)	
Non-agricultural	1066 (26.1)	483 (23.1)	583 (29.5)	
Not employed	1239 (30.2)	538 (26.9)	701 (33.8)	
Urban residence, n (%)	1744 (41.1)	833 (40.6)	911 (41.7)	0.617
Ethnicity, n (%)				
Akan	2037 (48.6)	931 (45.4)	1106 (52.2)	< 0.001
Ewe	291 (7.3)	134 (6.8)	157 (7.8)	
Ga-Adangbe	437 (10.6)	218 (10.2)	219 (11.0)	
Northern groups	485 (12.1)	279 (12.9)	206 (11.3)	
Other	936 (21.4)	624 (24.7)	312 (17.7)	
Median BMI (IQR)	22.2 (6.2)	21.8 (7.2)	22.6 (5.4)	< 0.0001
BMI category, n (%)				< 0.0001
Underweight	610 (14.8)	326 (15.0)	284 (14.6)	
Normal	2322 (55.0)	1345 (59.8)	977 (49.6)	
Overweight	788 (20.0)	371 (18.4)	417 (21.8)	
Obese	395 (10.2)	124 (6.7)	271 (14.0)	
Current alcohol use, n (%)	1320 (30.9)	962 (41.8)	358 (18.8)	< 0.0001
Chronic conditions, n (%)				< 0.0001

None	2767 (64.5)	1569 (68.5)	1198 (60.1)	
One	1020 (24.4)	470 (22.3)	550 (26.7)	
Two or more	457 (11.1)	176 (9.3)	281 (13.1)	
Self-rated health status, n (%)				< 0.0001
Poor/Very Poor	718 (17.1)	305 (14.8)	413 (19.6)	
Moderate	1820 (41.8)	894 (38.9)	926 (45.0)	
Good/Very Good	1723 (41.1)	1028 (46.3)	695 (35.4)	
Median WHODASi score (IQR)	85.4 (25)	87.5 (25)	81.2 (22.9)	< 0.0001
Adequate physical activity, n (%) ^a	3345 (77.3)	1856 (80.5)	1489 (73.6)	< 0.0001
Current tobacco use	530 (10.7)	424 (15.6)	106 (5.4)	< 0.0001
Adequate fruits and vegetables ^b	1273 (31.3)	627 (30.3)	646 (32.4)	0.175
Marital status				< 0.0001
Married/cohabiting	2410 (59.4)	1857 (85.1)	553 (30.9)	
Never/separated/divorced	651 (14.2)	208 (8.4)	443 (20.7)	
Widowed	1180 (26.4)	153 (6.6)	1027 (48.4)	
Religious attendance ^c	2679 (63.8)	1340 (62.3)	1339 (65.4)	0.092
Group participation ^d	1863 (43.6)	1028 (46.2)	835 (40.8)	< 0.01
Socially active ^e	1756 (40.6)	953 (42.4)	803 (38.7)	< 0.05
<p><i>*Significance based Adjusted Wald χ^2 test for nominal variables and Kruskal-Wallis test for medians of continuous variables; weighted counts were used for significance testing</i></p> <p><i>IQR: Interquartile range</i></p> <p><i>^a ≥ 600 metabolic equivalent minutes per week</i></p> <p><i>^b ≥ 5 servings in a typical day</i></p> <p><i>^c At least weekly attendance at religious services</i></p> <p><i>^d At least monthly attendance at voluntary group meetings</i></p> <p><i>^e Socializing with friends and/or coworkers at least 3 times per week</i></p>				

Table 2.2: Sociodemographic characteristics and risk behaviors by social ties, men

Characteristic	Social Ties								
	Marital Status			Religious		Socially active		Group member	
	Married	Widowed	Other	Yes	No	Yes	No	Yes	No
Age category, n (%)	****								
50 to 59	837 (43.0)	28 (16.7)	72 (37.0)	594 (41.5)	346 (39.2)	409 (42.5)	531 (39.2)	488 (44.6)	452 (37.1)
60 to 69	540 (27.1)	41 (23.6)	67 (28.2)	387 (26.9)	265 (27.2)	290 (27.9)	362 (26.4)	300 (28.1)	352 (26.1)
70 to 79	329 (20.8)	51 (33.8)	50 (24.0)	257 (22.6)	177 (21.1)	168 (20.0)	266 (23.6)	184 (21.0)	250 (23.0)
80+	151 (9.1)	33 (26.0)	19 (10.8)	102 (9.0)	101 (12.5)	86 (9.6)	117 (10.9)	56 (6.3)	147 (13.8)
Education, n (%)	**			****					
No formal education	817 (42.6)	81 (55.2)	78 (37.5)	544 (41.6)	441 (46.1)	402 (41.5)	583 (44.6)	366 (34.7)	619 (50.7)
Less than primary	174 (9.8)	15 (8.0)	35 (15.3)	127 (9.4)	97 (11.2)	112 (11.8)	112 (8.8)	124 (12.2)	100 (8.3)
Completed Primary	222 (12.2)	17 (10.7)	33 (17.1)	163 (12.4)	109 (12.6)	126 (13.7)	146 (11.5)	150 (15.0)	122 (10.2)
Completed jr. high	419 (24.0)	29 (20.4)	40 (21.5)	337 (25.6)	152 (19.8)	203 (22.1)	286 (24.4)	239 (24.6)	250 (22.4)
Completed secondary	116 (6.1)	6 (2.8)	11 (5.8)	82 (5.5)	51 (6.5)	62 (6.9)	71 (5.1)	82 (7.7)	51 (4.2)
University or higher	92 (5.3)	5 (3.0)	7 (2.8)	76 (5.6)	29 (3.8)	40 (4.2)	65 (5.5)	60 (5.7)	45 (4.2)
Wealth quintile, n (%)	****			****		****		***	
First (poorest)	317 (15.0)	42 (21.5)	63 (26.4)	202 (13.5)	224 (21.5)	168 (15.7)	258 (17.1)	146 (12.4)	280 (20.1)
Second	325 (16.2)	22 (16.5)	55 (26.8)	218 (15.1)	187 (20.6)	166 (16.4)	239 (17.7)	158 (15.1)	247 (18.9)
Third	357 (19.6)	26 (14.8)	52 (25.6)	248 (19.6)	187 (19.9)	241 (25.4)	194 (15.5)	210 (21.2)	225 (18.4)
Fourth	405 (22.4)	32 (23.1)	20 (12.3)	309 (23.2)	148 (18.5)	207 (21.8)	250 (21.2)	234 (21.6)	223 (21.3)
Fifth (least poor)	450 (26.8)	31 (24.1)	18 (8.9)	362 (28.6)	141 (19.5)	170 (20.6)	333 (28.5)	279 (29.7)	224 (21.3)
Employment, n (%)	**			****		****		****	
Agricultural	964 (51.0)	58 (41.5)	96 (45.8)	688 (50.4)	436 (49.5)	588 (61.7)	536 (41.2)	566 (55.5)	558 (45.2)
Non-agricultural	417 (23.8)	21 (14.0)	41 (22.2)	338 (25.9)	145 (18.3)	198 (21.4)	285 (24.4)	264 (26.2)	219 (20.3)

Not employed	410 (25.2)	68 (44.6)	60 (32.0)	283 (23.7)	255 (32.2)	146 (17.0)	392 (34.4)	167 (18.2)	371 (34.4)
Urban residence, n (%)	686 (40.6)	56 (37.4)	86 (43.8)	571 (44.6)***	262 (34.1)	298 (33.6)***	535 (45.8)	409 (40.9)	424 (40.4)
Ethnicity, n (%)		***		*		*		****	
Akan	734 (43.4)	75 (56.0)	120 (59.8)	583 (47.1)	348 (42.7)	451 (51.3)	480 (41.2)	445 (47.2)	486 (43.9)
Ewe	110 (6.9)	13 (7.9)	11 (5.4)	82 (6.7)	52 (7.0)	49 (6.0)	85 (7.4)	81 (9.2)	53 (4.8)
Ga-Adangbe	179 (10.1)	17 (10.0)	21 (10.9)	106 (8.5)	112 (13.0)	74 (8.0)	144 (11.8)	113 (11.1)	105 (9.4)
Northern groups	239 (13.3)	14 (8.6)	25 (11.7)	185 (13.8)	94 (11.4)	119 (12.7)	160 (13.0)	147 (14.1)	132 (11.8)
Other	558 (26.3)	30 (17.5)	29 (12.2)	347 (23.9)	277 (26.0)	233 (22.0)	391 (26.6)	220 (18.4)	404 (30.1)
Poor self-rated health, n (%)	229 (13.5)**	42 (27.9)	34 (18.5)	146 (12.3)***	159 (19.0)	98 (10.7)***	207 (17.8)	80 (8.3)****	225 (20.4)
Overweight or obese, n (%)	439 (27.0)****	23 (16.8)	33 (14.0)	340 (27.8)**	155 (20.5)	206 (23.6)	289 (26.3)	258 (26.4)	237 (24.1)
Current alcohol use, n (%)	784 (40.9)	66 (44.0)	107 (49.4)	448 (33.6)****	514 (55.6)	417 (43.2)	545 (40.8)	437 (42.4)	525 (41.3)
Chronic conditions, n (%)				****				*	
None	1318 (68.7)	97 (61.5)	144 (70.1)	900 (64.7)	669 (74.7)	665 (67.6)	904 (69.1)	700 (65.2)	869 (71.3)
One	380 (21.8)	37 (27.3)	52 (24.4)	331 (26.0)	139 (16.1)	217 (23.8)	253 (21.1)	250 (25.7)	220 (19.3)
Two or more	147 (9.6)	17 (11.1)	12 (5.6)	104 (9.3)	72 (9.3)	69 (8.6)	107 (9.8)	75 (9.1)	101 (9.4)
Adequate physical activity, n (%)	1571 (81.8)*	112 (70.1)	167 (77.7)	1163 (84.3)	693 (74.3)	878 (90.1)	978 (73.5)	918 (87.9)	938 (74.2)
Current tobacco use, n (%)	344 (15.1)	30 (16.2)	49 (21.2)	177 (10.9)****	247 (23.5)	174 (15.5)	250 (15.7)	157 (13.2)*	267 (17.7)
Adequate fruits and vegetables, n (%)	529 (30.3)	43 (31.9)	54 (29.1)	411 (32.5)*	216 (26.5)	291 (31.3)	336 (29.5)	246 (25.2)**	381 (34.6)
Significant p-values: * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$ **** $p < 0.0001$. Significance based Adjusted Wald χ^2 test for nominal variables and Kruskal-Wallis test for medians of continuous variables; weighted counts were used for significance testing									

Table 2.3: Sociodemographic characteristics and risk behaviors by social ties, women

	Social Ties								
	Marital Status			Religious		Socially active		Group member	
	Married	Widowed	Other	Yes	No	Yes	No	Yes	No
Age category, n (%)	****			****				****	
50 to 59	317 (57.7)	213 (22.8)	204 (49.8)	539 (43.1)	198 (31.5)	297 (39.3)	440 (38.9)	355 (44.7)	382 (35.2)
60 to 69	142 (26.8)	281 (29.5)	114 (25.9)	358 (28.1)	182 (27.6)	205 (28.2)	335 (27.8)	224 (27.9)	316 (28.0)
70 to 79	84 (13.9)	344 (31.6)	102 (20.2)	326 (21.3)	209 (28.7)	204 (22.9)	331 (24.5)	199 (21.7)	336 (25.4)
80+	10 (1.6)	189 (16.1)	23 (4.1)	116 (7.5)	107 (12.2)	97 (9.6)	126 (8.8)	57 (5.7)	166 (11.4)
Education, n (%)	****			**		*		****	
No formal education	331 (59.9)	768 (74.9)	238 (51.2)	837 (61.9)	509 (72.2)	550 (67.8)	796 (64.0)	498 (58.4)	848 (70.3)
Less than primary	58 (11.5)	85 (9.0)	55 (12.7)	147 (11.7)	53 (8.4)	84 (11.8)	116 (9.8)	94 (12.3)	106 (9.3)
Completed Primary	55 (10.2)	80 (7.5)	55 (13.5)	137 (10.7)	53 (7.3)	67 (8.1)	123 (10.4)	90 (10.6)	100 (8.7)
Completed jr. high	74 (12.7)	66 (6.0)	72 (17.6)	152 (11.1)	61 (9.2)	78 (9.7)	135 (10.9)	97 (11.6)	116 (9.6)
Completed secondary	14 (2.8)	17 (1.7)	9 (1.9)	28 (2.1)	12 (2.0)	14 (1.9)	26 (2.2)	28 (3.8)	12 (0.9)
University or higher	16 (3.0)	10 (0.9)	12 (3.1)	32 (2.5)	6 (0.9)	7 (0.8)	31 (2.7)	26 (3.3)	12 (1.1)
Wealth quintile, n (%)	****			**		****		****	
First (poorest)	83 (14.8)	244 (23.8)	94 (20.4)	241 (17.8)	180 (24.6)	152 (18.5)	269 (21.2)	127 (15.4)	294 (23.5)
Second	102 (18.8)	235 (22.4)	97 (21.8)	287 (21.6)	152 (20.7)	201 (24.8)	238 (19.1)	171 (19.6)	268 (22.4)
Third	106 (20.2)	223 (23.3)	82 (19.3)	286 (22.2)	126 (20.1)	183 (23.4)	229 (20.2)	181 (21.7)	231 (21.2)
Fourth	135 (24.4)	180 (17.3)	90 (19.1)	293 (21.9)	114 (15.9)	173 (22.5)	234 (18.2)	199 (24.0)	208 (17.0)
Fifth (least poor)	125 (21.8)	142 (13.2)	80 (19.4)	228 (16.5)	123 (18.7)	91 (10.9)	260 (21.3)	157 (19.3)	194 (15.9)
Employment, n (%)	****			****		****		****	
Agricultural	222 (41.5)	320 (33.8)	156 (36.5)	527 (41.8)	174 (26.8)	345 (45.1)	356 (31.3)	328 (41.4)	373 (33.4)
Non-agricultural	192 (34.9)	246 (24.2)	140 (33.6)	416 (31.3)	167 (26.1)	221 (28.0)	362 (30.5)	298 (36.6)	285 (24.6)
Not employed	124 (23.6)	433 (42.0)	140 (29.9)	375 (26.9)	326 (47.1)	230 (26.9)	471 (38.2)	196 (22.1)	505 (42.0)
Urban residence, n (%)	222 (38.0)	460 (41.5)	223 (47.6)	598 (41.1)	313 (42.8)	297 (34.2)**	614 (46.4)	380 (42.1)	531 (41.4)

Ethnicity, n (%)		****		***		**		****	
Akan	269 (49.8)	533 (48.5)	298 (64.2)	773 (56.9)	333 (43.4)	495 (60.6)	611 (46.9)	446 (52.0)	660 (52.3)
Ewe	45 (7.7)	79 (7.6)	31 (8.3)	96 (7.6)	61 (8.3)	55 (7.5)	102 (8.1)	89 (11.5)	68 (5.3)
Ga-Adangbe	58 (10.3)	115 (11.8)	46 (10.6)	122 (9.0)	97 (14.8)	59 (7.2)	160 (13.4)	108 (12.6)	111 (9.9)
Northern groups	61 (10.4)	97 (11.3)	47 (12.5)	134 (10.3)	72 (13.0)	70 (9.3)	136 (12.4)	85 (11.1)	121 (11.3)
Other	106 (21.7)	183 (20.9)	20 (4.4)	185 (16.2)	127 (20.5)	106 (15.4)	206 (19.2)	95 (12.8)	217 (21.1)
Poor self-rated health, n (%)	86 (15.5)*	234 (22.2)	90 (19.2)	205 (14.1)****	208 (30.0)	133 (15.0)***	280 (22.5)	90 (10.1)****	323 (26.1)
Current alcohol use, n (%)	113 (21.2)	162 (17.5)	81 (18.5)	204 (16.6)**	154 (23.0)	119 (15.5)*	239 (21.0)	147 (19.0)	211 (18.7)
Overweight or obese, n (%)	211 (37.6)*	315 (32.4)	157 (40.3)	498 (38.1)*	190 (30.7)	265 (33.6)	423 (37.0)	331 (41.7)***	357 (31.3)
Chronic conditions, n (%)		**		**					
None	366 (66.7)	568 (56.5)	258 (59.2)	820 (63.1)	378 (54.5)	458 (58.9)	740 (60.9)	472 (58.0)	726 (61.2)
One	135 (23.9)	300 (28.8)	112 (25.9)	359 (25.7)	191 (28.7)	221 (26.8)	329 (26.7)	232 (27.2)	318 (26.4)
Two or more	49 (9.4)	157 (14.7)	72 (14.9)	159 (11.2)	122 (16.8)	124 (14.3)	157 (12.4)	130 (14.8)	151 (12.0)
Adequate physical activity, n (%)	437 (79.1)**	719 (69.6)	327 (75.4)	1063 (79.7)****	426 (62.1)	697 (87.4)****	792 (64.9)	694 (84.0)****	795 (66.5)
Current tobacco use, n (%)	27 (5.1)	61 (6.2)	17 (4.0)	51 (3.9)**	55 (8.3)	46 (5.7)	60 (5.2)	41 (4.5)	65 (6.1)
Adequate fruits and vegetables, n (%)	180 (34.7)	316 (30.4)	142 (32.4)	453 (34.7)*	193 (28.0)	300 (37.3)*	346 (29.3)	197 (24.5)****	449 (37.9)

Table 2.4: Prevalence ratio associations of social ties with CVD risk behaviors among Ghanaian older adults												
Sex and indicator of social tie	Model 1 ^a			Model 2 ^b			Model 3 ^c			Model 4 ^d		
	PR	95% CI	n	PR	95% CI	n	PR	95% CI	n	PR	95% CI	n
Current Tobacco Use												
Men												
Married	0.78	(0.58 , 1.05)	2200	0.76	(0.55 , 1.03)	2059	0.78	(0.57 , 1.06)	1989	0.76	(0.55, 1.04)	1926
Religious	0.46	(0.36 , 0.59)	2211	0.56	(0.44, 0.70)	2069	0.72	(0.57 , 0.91)	1997	0.71	(0.56, 0.89)	1933
Socially active	0.98	(0.79 , 1.23)	2211	0.97	(0.76 , 1.22)	2069	0.99	(0.78, 1.25)	1997	1.00	(0.79, 1.28)	1933
Group member	0.74	(0.59 , 0.93)	2211	0.89	(0.71 , 1.13)	2069	1.00	(0.79 , 1.26)	1997	1.00	(0.79, 1.27)	1933
Women												
Married	1.06	(0.66, 1.71)	2019	1.00	(0.59 , 1.7)	1931	0.98	(0.58 , 1.63)	1854	1.05	(0.62, 1.78)	1775
Religious	0.49	(0.32 , 0.76)	2031	0.63	(0.41, 0.95)	1943	0.68	(0.46, 0.99)	1866	0.72	(0.49, 1.05)	1786
Socially active	1.11	(0.69 , 1.80)	2031	1.39	(0.86, 2.24)	1943	1.49	(0.94, 2.35)	1866	1.55	(0.98, 2.45)	1786
Group member	0.76	(0.50, 1.16)	2031	1.03	(0.66 , 1.60)	1943	1.11	(0.71, 1.72)	1866	1.08	(0.68, 1.71)	1786
Adequate physical activity												
Men												
Married	1.07	(0.99, 1.15)	2218	1.03	(0.96 , 1.11)	2092	1.04	(0.964, 1.12)	2017	1.02	(0.95, 1.10)	1936
Religious	1.13	(1.06 , 1.20)	2229	1.12	(1.06 , 1.18)	2102	1.13	(1.07, 1.20)	2025	1.12	(1.06, 1.19)	1943
Socially active	1.21	(1.15 , 1.29)	2229	1.12	(1.06 , 1.18)	2102	1.1	(1.05 , 1.17)	2025	1.1	(1.04, 1.16)	1943
Group member	1.16	(1.1 , 1.23)	2229	1.13	(1.07 , 1.18)	2102	1.12	(1.07 , 1.18)	2025	1.11	(1.06, 1.17)	1943
Women												
Married	1.03	(0.96, 1.11)	2023	1.04	(0.98 , 1.1)	1934	1.05	(1.00, 1.11)	1855	1.05	(1.00, 1.11)	1776
Religious	1.25	(1.15, 1.34)	2035	1.18	(1.11 , 1.26)	1946	1.17	(1.1, 1.25)	1867	1.16	(1.09, 1.23)	1788
Socially active	1.35	(1.25 , 1.45)	2035	1.26	(1.18 , 1.35)	1946	1.24	(1.17 , 1.32)	1867	1.23	(1.16, 1.31)	1788
Group member	1.23	(1.16 , 1.30)	2035	1.19	(1.13 , 1.26)	1946	1.17	(1.11 , 1.23)	1867	1.16	(1.10, 1.22)	1788
Adequate fruit and vegetable consumption												
Men												

Married	0.97	(0.80, 1.18)	2211	0.95	(0.77 , 1.18)	2070	0.93	(0.75, 1.16)	2000	0.93	(0.76, 1.15)	1936
Religious	1.21	(0.99 , 1.48)	2222	1.2	(0.98 , 1.47)	2080	1.2	(0.98, 1.48)	2008	1.2	(0.99, 1.46)	1943
Socially active	1.06	(0.89 , 1.26)	2222	1.11	(0.92, 1.33)	2080	1.1	(0.92, 1.32)	2008	1.12	(0.94, 1.35)	1943
Group member	0.71	(0.58, 0.87)	2222	0.67	(0.56, 0.81)	2080	0.67	(0.56, 0.81)	2008	0.69	(0.57, 0.83)	1943
Women												
Married	1.08	(0.91, 1.28)	2020	1.11	(0.93 , 1.33)	1926	1.11	(0.93, 1.33)	1849	1.1	(0.92, 1.32)	1776
Religious	1.22	(1.02 , 1.45)	2032	1.22	(1.02, 1.46)	1938	1.19	(0.99, 1.42)	1861	1.24	(1.03, 1.50)	1788
Socially active	1.27	(1.06 , 1.51)	2032	1.27	(1.06 , 1.53)	1938	1.25	(1.04 , 1.51)	1861	1.31	(1.09, 1.57)	1788
Group member	0.63	(0.52 , 0.77)	2032	0.6	(0.49, 0.73)	1938	0.59	(0.49, 0.73)	1861	0.61	(0.50, 0.75)	1788
^a Adjusted for age ^b Additionally adjusted for employment, wealth quintile, education, urban residence, and ethnicity ^c Additionally adjusted for overweight and alcohol use ^d Additionally adjusted for self-rated health status, number of chronic conditions, and having above median WHODASi score <i>Note: all regressions were adjusted for complex survey design using 'survey' package in R.</i>												

Table 2.5: Prevalence ratio associations of social ties with CVD risk behaviors among Ghanaian older adults, mutually adjusted for other social ties						
Sex and indicator of social tie	Current Tobacco Use		Adequate Physical Activity		Adequate fruit and vegetable consumption	
	PR	95% CI	PR	95% CI	PR	95% CI
Men	(n = 1926)		(n = 1936)		(n = 1936)	
Married	0.76	(0.56 , 1.03)	1.02	(0.94, 1.09)	0.95	(0.77 , 1.16)
Religious	0.69	(0.54 , 0.87)	1.09	(1.03, 1.16)	1.25	(1.02 , 1.53)
Socially active	1.08	(0.85 , 1.38)	1.06	(1.01 , 1.13)	1.18	(0.98, 1.42)
Group member	1.04	(0.81, 1.33)	1.08	(1.02 , 1.13)	0.65	(0.53 , 0.79)
Women	(n = 1810)		(n = 1776)		(n = 1776)	
Married	1.05	(0.61, 1.81)	1.04	(0.99 , 1.1)	1.06	(0.89 , 1.25)
Religious	0.64	(0.41 , 1.00)	1.10	(1.03, 1.17)	1.27	(1.04, 1.54)
Socially active	1.69	(1.04 , 2.74)	1.18	(1.11, 1.26)	1.36	(1.13, 1.64)
Group member	1.10	(0.66, 1.82)	1.12	(1.06, 1.18)	0.57	(0.47, 0.70)
<i>Models were adjusted for age, education, wealth quintile, employment, urban residence, ethnicity, overweight, alcohol use, self-rated health, number of chronic conditions, and WHODASi score</i>						

Chapter 3: Paper 2

Title: Health access and awareness of hypertension status among Ghanaian older adults

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Abstract

Purpose:

While cardiovascular diseases and other chronic non-communicable diseases have been shown to have increasing prevalence in developing countries, awareness tends to be very low in these settings. This study seeks to assess whether responsiveness of care, provider type, health insurance, and frequency of outpatient visits may be associated with awareness of hypertension diagnosis among Ghanaian adults 50 years and older.

Methods:

In the WHO's Study on global AGEing and adult health (SAGE), awareness of diagnosis for hypertension was based on self-report among those who had elevated blood pressure when measured during the survey. Health care factors were based on self-report and included having health insurance, frequency of outpatient visits in the previous 12 months, type of provider last seen, and health system responsiveness. The association between awareness of hypertension status and health access factors were assessed in separate robust Poisson regressions adjusted for sociodemographic covariates.

Results:

Having health insurance (PR 1.29, 95% CI 1.07 – 1.56) and utilizing outpatient services within the past 12 months (PR 1.47, 95% CI 1.13 – 1.92) were

significantly associated with an increased likelihood of being aware of hypertension diagnosis, while having a pharmacist as the most recent provider was associated with a significantly decreased likelihood (PR 0.3, 95% CI 0.19 – 0.49) of awareness of hypertension diagnosis.

Conclusion:

Access to care is an important factor for improving awareness of hypertension diagnostic status. Improvements in accessibility, provider training, diagnostic capacity, and risk factor awareness among the population will be important in improving early detection of hypertension and prevention of CVD.

Introduction

Non-communicable diseases (NCDs) are major sources of morbidity and mortality globally, with 80% of the burden being borne by low and middle-income countries (LMIC) [1–3]. Eighty percent of all cardiovascular disease-related mortality occur in LMIC, with the burden in these countries expected to increase with their improving economic conditions, increased aging of populations, and higher levels of urbanization [2, 4–7]. Already taxed with addressing the continuing burden of infectious diseases, health systems in developing countries are challenged to address the growing burden of NCDs [8–11]. This has significant health and economic consequences in LMIC [12–16].

Cardiovascular diseases such as stroke and ischemic heart disease accounted for 18% of total premature deaths in Ghana in 2012 [17]. Hypertension is a leading risk factor for CVD in Ghana, and has remained one of the top five causes for outpatient visits since 1990 [18]. Previous studies of hypertension in Ghana have revealed high prevalence, although these studies have been in selective populations and have not been nationally representative [19]. Nevertheless, they allude to a trend of increasing prevalence among both urban and rural populations [19, 20]. However, similar to trends in other LMIC, the likelihood of diagnosis, treatment, and control of hypertension in Ghana are very low [4, 6, 21].

Awareness is a necessary motivation for engaging in preventive and treatment behaviors. The high prevalence of hypertension in Ghana and other developing countries, but low levels of awareness are indicative of constraints in the provision and receipt of diagnostic services for prevention and early detection of hypertension and other chronic conditions. Challenges in accessing care may play an important role for awareness [22]. Factors related to access to medical care have important implications for awareness and subsequent treatment of chronic conditions. Without regular contact with the health system, a largely asymptomatic condition such as hypertension will likely go undiagnosed and untreated.

It is also important to consider aspects a patient's interaction with the health system that may affect subsequent care seeking and uptake of health provider's recommendations [23, 24]. The concept of health system responsiveness seeks to capture the quality of interpersonal processes that occur between patient and provider during an encounter [23]. It focuses on the non-clinical aspects of care provision, as opposed to expectations of clinical outcomes, and can be conceived of in two broad categories: respect for the individual patient and the general client orientation of the health system in the provision of services [25]. Respect for the patient entails the autonomy of the patient to decide on the course of treatment, confidentiality and privacy of the patient's

personal information and the right to safeguard access to such information, and respect for the dignity of the patient as a person. Patient centeredness in the provision of services is also multidimensional and encompasses the following domains: prompt attention when patient seeks care, quality of basic amenities in the place of care, freedom to choose who provides the needed care, and access to social supports [23, 25]. In order to address the lack of awareness of hypertension diagnostic status among older Ghanaians, it is important to understand the role traditional barriers of health care access as well as the perceptions of the health care encounter. This study seeks to assess the association of insurance status, health system responsiveness, outpatient service utilization, and provider type on with awareness of hypertension awareness status among a nationally representative sample of Ghanaian older adults.

Methods

Study sample

Data collected in Ghana for Wave 1 of the WHO Study on Global Ageing and Adult Health (SAGE) will be used in this analysis. SAGE is a multi-country longitudinal survey of nationally representative samples of adults aged 50 and older which aims to collect comparable, valid, and reliable data across several domains of health and well-being. Household and individual level data were

collected from samples in China, Ghana, India, Mexico, Russian Federation, and South Africa. The analyses being conducted involve only one wave of data from Ghana. This publicly available data was accessed through a data repository from the Interuniversity Consortium for Political and Social Research (ICPSR) at the University of Michigan.

The SAGE Wave 1 sample was drawn from a sampling frame developed from Ghana's 2000 Population and Housing census and updated in 2007 before the data collection commenced [27]. This was stratified into the 10 administrative regions in the country, and the sampling frame included 250 enumeration areas (EA) selected from these strata [27]. The number of EAs selected from each stratum was determined by probability proportional to size, with size being denoted by the number of EAs in each stratum. Selection of EAs within each stratum was then by probability proportional to EA size, with size being denoted by the number of 50 years and older individuals residing in an EA. In each selected EA, households were classified into one of three categories [27]:

- 1) A follow-up household from the 2003 WHO World Health Survey (WHS), also considered to be SAGE Wave 0, with one or more adults 50 years or older.
- 2) New households with at least one adult aged 50 years or older.

- 3) A SAGE Wave 0 follow-up household with no adults aged 50 or older but adults 18-49 years old.
- 4) New households with no adult 50 years or older but adults 18-49 years old.

For a target sample size of 5,000 50-plus households and 1,000 18-49 households, 24 households were to be selected in each EA, with 20 being 50-plus households [27]. All SAGE Wave 0 households (category 1) with at least one member 50 years or older were eligible for the interviews [27]. If there were not enough such households in an EA, the remaining 50-plus households were systematically selected from the list of new 50-plus households (category 2) [27]. Four SAGE Wave 0 households with adults less than 50 years old (category 4) were randomly selected [28]. All adults 50 years and older in each household were eligible to be interviewed [27, 29]. One adult from each of the four 18-49 in each EA was randomly selected to be interviewed [29]. There were 5,178 households and 5,571 individuals selected for interviews. The household and individual response rates were 97.7% and 93.8%, respectively [27].

For this analysis, a sample of 2,403 individuals aged 50 or older who completed the survey, had either self-reported or measured hypertension, and had non-missing cluster and sample weight data were selected.

Data collection

The SAGE survey questionnaire was adapted from the instruments and methods used in the 2003 WHO World Health Survey (WHS) and pretested in 2005 with 1500 respondents in Ghana, India, and Tanzania [30]. The questionnaire consists of the following six main instruments: household questionnaire, individual questionnaire, proxy respondent questionnaire, proxy validation questionnaire, retest questionnaire, and verbal autopsy questionnaire [27]. The proxy validation and retest questionnaires were included as quality control measures [27].

Interviewers were trained and supervised during data collection. Data collection was conducted using paper and pencil during face to face interviews. If an individual selected for an interview was incapable of answering the individual questionnaire due to inability to comprehend, the interview was conducted with a family member as a proxy. There were a total of 16 proxy interviews completed [28].

Measures

Main independent variables

Health system responsiveness was derived from responses to 7 domains of questions about the most recent outpatient encounter with the health system.

Respondents were asked to rate their experiences in the following areas: waiting time, respectful treatment, clear communication by provider, involvement in decision-making, privacy, choice of provider, and cleanliness of health facility. Possible responses were “very good”, “good”, “moderate”, “bad”, and “very bad”, with numerical values of 1, 2, 3, 4, and 5, respectively. These were reverse coded and rescaled from 0 to 4, such that 0 corresponded with a rating of “very bad” and 4 corresponded with a rating of “very good”. A summary score for responsiveness was obtained using principal components analysis (PCA) and then scaled from 0 to 100, with 0 indicating least responsive and 100 indicating most responsive. Finally, this was standardized by subtracting the mean and dividing by the standard deviation.

Health insurance status was derived from response provided by head of household to question of whether the respondent had health insurance. A dichotomous insurance variable was coded 1 for responses indicating that the respondent had mandatory insurance, voluntary insurance, or both. Otherwise, the variable was coded as 0.

Utilization of outpatient services was based on response to a question about whether the respondent had an outpatient visit at a health care facility in the past 12 months, and was coded 1 for “yes” and 0 for “no”.

Type of provider was based on a question regarding who the respondent saw at their most recent outpatient visit, for those who had an outpatient visit in the past previous 12 months. Possible responses were “medical doctor”, “nurse or midwife”, “pharmacist”, “traditional healer”, “dentist”, “physiotherapist”, and “home health care worker”. There were limited responses in the latter 4 categories and therefore were reclassified as “other” for the regression.

Dependent variable

Awareness of hypertension status is the dependent variable of interest in this analysis. Awareness of hypertension status was derived from respondent’s self-report of hypertension and whether or not the respondent had elevated blood pressure during the time of the survey.

Covariates

Regression models controlled for the following demographic characteristics: age, sex, permanent income quintile, education, ethnicity, and residence. Permanent income quintile was already derived and included in the SAGE dataset, with the first quintile being poorest and the fifth quintile being wealthiest. The derivation of permanent income values from asset, household characteristic, and access to services data in the SAGE survey are described

elsewhere [27, 29, 31]. The following categorical age bands were created from the continuous age variable: 50 to 59 years, 60 to 69 years, 70 to 79 years, and 80 plus. Educational status was assessed based on responses to a question on a respondent's highest level of education completed. For this analysis, responses were collapsed into the following categories: "no formal education", "primary or less", "completed junior high", and "completed secondary school or higher". Ethnicity was grouped into the following five categories: Akan, Ewe, Ga-Adangbe, Northern groups, and other. Urban residence was dichotomized (0 = false, 1 = true).

It is possible that respondents may have visited a health provider due to already diagnosed chronic condition or poor health, and this may confound the associations with awareness. Therefore, the regression models also controlled for number of chronic conditions and self-rated health status. The chronic conditions included in the analysis were diabetes, arthritis, stroke, angina, chronic lung disease, asthma, cataracts, and loss of all teeth. In the survey, respondents were asked if they had been diagnosed by a medical professional with each of the chronic conditions. For this analysis, responses were coded as 1 = self-report of being diagnosed with the condition and 0 = self-report of never being diagnosed with the condition. A new categorical variable was derived

comprising the number of these conditions a respondent self-reported, with the following possible values: “None”, “One”, “Two or more”.

Self-rated health status was derived based on response to the following survey question: “in general, how would you rate your health today?”. Possible responses were “very good”, “good”, “moderate”, “bad”, and “very bad”. A trichotomized health status variable was derived, with “very good” and “good” responses categorized as “good”, “bad” and “very bad” categorized as “poor”, and “moderate” remained unchanged.

Statistical analysis

Initial descriptive statistics were computed for the analysis sample, assessing the distribution of the independent variables by sociodemographic covariates. The prevalence ratio (PR) associations between awareness of hypertension status and the health systems factors were modeled using design-based Poisson regression models with robust standard errors [32–35]. Separate regression models were fit for the associations between each health systems factor and the awareness outcome. An initial model assessed unadjusted associations, with subsequent models adjusting for sociodemographic covariates and health status.

Results

Sample characteristics

The overall awareness of hypertension status was 20%. Table 3.1 presents the characteristics of the study sample by the four health care access factors of interest. Overall, 38% of the sample reported having some health insurance. There were positive gradients in health insurance coverage by age, education level, and wealth quintile. There were negative gradients in the likelihood of not having an outpatient visit in the past 12 months by age and wealth quintile, and those with secondary school or higher education were least likely to have had no visit. Northern and “other” ethnic groups were significantly more likely to not have visited a health facility in the previous 12 months. Those of older age, higher education, higher wealth quintile, urban residence, and poor health were more likely to have visited a doctor than other providers.

The seven items for the health system responsiveness index were found to have good internal consistency (Cronbach’s $\alpha = 0.82$, 95% CI 0.8 – 0.83). Examination of the scree plot and number of components with eigenvalues greater than 1 resulted in extracting item loadings from only the first principal component, accounting for 68.5% of the variability among the items. The health system was rated as moderately responsive (66%, SE 0.79), with men, those with

good self-rated health, the Akan and “other” ethnic groups being likely to rate responsiveness slightly higher.

Unadjusted and adjusted associations

Table 3.2 presents the results of unadjusted and adjusted associations between awareness of hypertension status and each of the health access factor. In unadjusted models regressing awareness of hypertension status separately on each factor, having health insurance, outpatient visit in the past month, and type of provider seen were significantly associated with likelihood of awareness of hypertension status. Having health insurance increased the likelihood of awareness by 65% (PR 1.65, 95% CI 1.33 – 2.02), while outpatient utilization increased the likelihood by 88% (PR 1.88, 95% CI 1.43 – 2.46). When compared with those whose most recent outpatient visit was with a doctor, those who visited with a nurse (PR 0.6, 95% CI 0.43 – 0.84) or a pharmacist (PR 0.18, 95% CI 0.12 – 0.29) were significantly less likely to be aware of their hypertension status.

When adjusted for sociodemographic characteristics (age, sex, education, wealth quintile, urban residence, ethnicity), the association with nurse as provider is no longer significant, although the associations remain for care provision by a pharmacist, health insurance, and outpatient utilization. In a final model adjusted for poor health and number of chronic conditions, the significant

associations remained. In this fully adjusted model, having health insurance significantly increased the likelihood of awareness by 29%, utilization of outpatient services increased the likelihood of awareness by 47%, and having a pharmacist as the most recent provider decreased the likelihood by 60%. The standardized health system responsiveness score was not significantly associated with awareness in any of the models.

Discussion

This study sought to examine health access factors that may be associated with awareness of hypertension diagnostic status among a nationally representative sample of Ghanaian older adults. There were important socioeconomic gradients observed in the bivariate associations of the sample characteristics with the factors of access considered in the analysis. Those with better education or in higher wealth quintiles were more likely to have insurance, utilize care, and to see a doctor during an outpatient visit.

The findings reveal that factors important in health access were associated with awareness of diagnostic status among Ghanaian older adults. Utilization, insurance, and type of provider were important factors associated with the likelihood of awareness of hypertension diagnostic status. Lack of health insurance has been widely associated with decreased utilization of health

services [36]. For asymptomatic conditions such as hypertension, regular contacts with the health system present opportunities for routine screening by a trained health professional [36, 37]. In a multi-country study, the authors found significant levels of unawareness of hypertension status, and proposed that issues with accessing care may be important factors [38]. A study in the US found that having insurance increased the likelihood of awareness by 20% [39]. In the current analysis, health insurance increased the likelihood of awareness by 29%. However, other US studies found no such association [40, 41].

In this study, type of provider was found to be significantly associated with awareness of hypertension status. Those who saw a pharmacist at their last outpatient encounter were significantly less likely to be aware of their hypertension status. A provider's level of training has important implications for advice given, appropriateness of diagnosis, and treatment given to a patient [42]. Moreover, understanding frequent sources of care and the implications for awareness may provide opportunities for interventions to integrate providers into the continuum of prevention, awareness, and management of hypertension and other CVD related conditions.

Responsiveness of care is an important health system goal, and it may improve satisfaction with care and subsequent utilization [26, 43, 44]. Therefore, it is possible that improved health system responsiveness would be associated

with increased likelihood of awareness of hypertension status. However, this study found no significant association.

Screening and early detection of hypertension are important aspects of effectively managing the growing prevalence of CVD, and opportunistic screening is one of the objectives of the Ministry of Health's strategy for prevention and management of NCDs in Ghana [45]. However, for this to be effective and equitable, access to primary care must be improved, with a particular concern for the socioeconomic gradients in insurance and utilization of outpatient care. Furthermore, while being able to access care improves likelihood of awareness, level is still considerable low for those with insurance (27%), those who had an outpatient visit (24%), and those who were seen by a doctor (32%). An extensive network of community clinics, created through the Community Health and Planning Services initiative which aimed to improve geographic access to care [46], is an important avenue for enhancing availability of diagnostic services and early detection of hypertension. This can be accomplished by improving training and diagnostic capacity for hypertension and other NCDs in these facilities at the community level and improving awareness of risk factors for hypertension and other NCDs among the population.

In conclusion, this study confirmed previous research on the importance of factors that affect health care access for improving awareness of hypertension diagnostic status.

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Table 3.1: Sociodemographic characteristics of study sample

Characteristics	Insured n (%)	HS Responsive-ness Mean (SE)	Number of outpatient visits n (%)			Most recent provider n (%)			
			None	1-2	3+	Doctor	Nurse	Pharmacist	Other
Sex	NS	*	**			NS			
Male	452 (38.9)	67.5 (1.1)	400 (36.0)	386 (37.1)	291 (26.9)	496 (61.2)	172 (18.3)	147 (16.3)	29 (4.2)
Female	490 (38.1)	64.7 (0.9)	335 (28.2)	470 (40.6)	377 (31.3)	384 (61.1)	118 (15.9)	147 (18.6)	32 (4.5)
Age category	***	NS	**			*			
50 to 59	281 (30.0)	66.3 (0.9)	325 (37.6)	313 (37.3)	217 (25.0)	290 (56.7)	93 (16.9)	125 (21.6)	21 (4.8)
60 to 69	271 (37.8)	65.3 (1.2)	215 (30.2)	241 (39.7)	200 (30.1)	247 (59.3)	87 (18.5)	85 (17.2)	24 (5.0)
70+	390 (49.5)	66.3 (1.2)	195 (26.8)	302 (39.9)	251 (33.2)	343 (67.2)	110 (16.4)	84 (13.1)	16 (3.3)
Education	***	NS	NS			***			
No formal education	453 (35.6)	65.9 (1.0)	406 (34.8)	458 (38.6)	320 (26.6)	413 (56.8)	164 (18.6)	171 (20.5)	30 (4.1)
Primary or less	207 (37.1)	65.9 (1.4)	150 (28.7)	192 (42.3)	156 (29.1)	186 (56.6)	67 (18.7)	75 (19.3)	18 (5.4)
Completed Jr. high	174 (40.4)	65.8 (1.7)	132 (30.7)	145 (36.1)	127 (33.2)	192 (72.0)	39 (13.0)	34 (10.6)	9 (4.5)
Secondary or higher	103 (58.0)	66.7 (1.9)	41 (24.3)	57 (37.9)	64 (37.8)	87 (74.5)	18 (13.9)	13 (9.1)	4 (2.5)
Wealth quintile	***	NS	*			***			
First (poorest)	99 (25.3)	66.3 (1.6)	149 (41.4)	137 (37.8)	72 (20.7)	86 (42.2)	44 (19.3)	68 (32.9)	10 (5.6)
Second	135 (30.7)	65.8 (1.3)	150 (34.9)	160 (38.3)	112 (26.8)	128 (52.8)	59 (19.1)	70 (24.1)	11 (3.9)
Third	172 (33.1)	67.7 (1.2)	135 (29.1)	168 (39.6)	147 (31.3)	144 (47.9)	75 (23.3)	77 (22.2)	18 (6.6)
Fourth	238 (42.3)	65.8 (1.3)	159 (31.9)	173 (36.7)	168 (31.4)	216 (66.8)	71 (18.0)	43 (11.0)	13 (4.2)
Fifth (wealthiest)	298 (53.1)	64.9 (1.4)	141 (27.0)	215 (40.9)	168 (32.0)	304 (80.7)	41 (9.8)	34 (7.2)	9 (2.3)
Residence	NS	NS	NS			***			

Urban	495 (41.5)	64.8 (1.2)	321 (30.5)	403 (37.7)	351 (31.8)	544 (75.8)	93 (9.6)	102 (11.6)	24 (3.0)
Rural	447 (35.8)	67.1 (1.0)	414 (33.4)	453 (39.8)	317 (26.8)	336 (47.2)	197 (24.4)	192 (22.8)	37 (5.6)
Ethnicity	NS	***	***			***			
Akan	534 (42.4)	67.7 (1.1)	339 (28.0)	462 (40.7)	395 (31.3)	484 (60.4)	167 (17.5)	168 (16.9)	38 (5.1)
Ewe	58 (35.6)	57.8 (2.2)	41 (28.1)	64 (42.2)	44 (29.8)	75 (69.4)	18 (15.7)	13 (14.2)	1 (0.7)
Ga-Adangbe	83 (29.9)	61.0 (1.6)	69 (27.8)	91 (39.5)	76 (32.7)	100 (60.6)	31 (17.5)	24 (15.3)	10 (6.6)
Northern groups	105 (35.9)	63.9 (1.5)	111 (42.7)	82 (27.1)	72 (30.2)	108 (74.7)	16 (7.8)	31 (16.4)	2 (1.0)
Other	150 (35.8)	67.3 (1.4)	159 (40.6)	143 (39.7)	73 (19.7)	97 (48.4)	57 (25.4)	55 (23.2)	8 (3.1)
Self-rated health status	NS	*	***			**			
Poor	178 (37.7)	63.7 (1.5)	97 (20.7)	158 (39.1)	179 (40.2)	206 (65.0)	50 (12.0)	68 (17.4)	15 (5.7)
Moderate	413 (40.9)	65.3 (1.0)	279 (28.9)	338 (36.8)	329 (34.3)	385 (61.2)	141 (19.7)	123 (16.7)	20 (2.3)
Good	351 (36.5)	68.2 (1.0)	359 (40.5)	360 (40.7)	160 (18.7)	289 (58.6)	99 (17.4)	103 (18.1)	26 (5.9)
<i>HS: Health system</i> <i>* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$. Significance based on adjusted Wald χ^2 test for categorical variables and sampling weighted t-test for continuous health system responsiveness variable.</i>									

Table 3.2: Unadjusted and adjusted association of health access factors with awareness of hypertension status						
	Model 1 ^a		Model 2 ^b		Model 3 ^c	
	PR (95% CI)	n	PR (95% CI)	n	PR (95% CI)	n
Insurance	1.65 (1.33, 2.02)	2257	1.33 (1.09, 1.61)	2202	1.29 (1.07, 1.56)	2199
Responsiveness	0.94 (0.84, 1.05)	1384	1.03 (0.92, 1.14)	1354	1.01 (0.91, 1.12)	1353
Utilization*	1.88 (1.43, 2.46)	2125	1.56 (1.2, 2.04)	2072	1.47 (1.13, 1.92)	2069
Provider		1403		1373		1372
Doctor	Reference		Reference		Reference	
Nurse	0.6 (0.43, 0.84)		0.75 (0.55, 1.03)		0.8 (0.59, 1.09)	
Pharmacist	0.18 (0.12, 0.29)		0.27 (0.17, 0.44)		0.3 (0.19, 0.49)	
Other	0.73 (0.37, 1.45)		0.96 (0.54, 1.7)		0.93 (0.51, 1.69)	
<p>* Outpatient visit in past 12 months</p> <p>^a Crude bivariate association</p> <p>^b Additionally adjusted for age, sex, wealth quintile, education, urban residence, and ethnicity</p> <p>^c Additionally adjusted for poor health and number of chronic conditions</p> <p>PR: Prevalence ratio</p> <p><i>Note: all regressions were adjusted for complex survey design using 'survey' package in R.</i></p>						

Chapter 4: Paper 3

Title: The role of social integration in hypertension management behaviors among Ghanaian older adults.

Author: Jonathan K. Akuoku

Abstract

Purpose:

The level of social integration been found to have significant associations with health behaviors in numerous studies, although much of the evidence stems from studies conducted in developed country contexts. This study examines the association of a composite measure of social integration with appropriate hypertension management behaviors among a nationally representative sample of Ghanaian older adults.

Methods:

Data from Ghana Wave 1 dataset of the WHO Study on global AGEing and adult health (SAGE), a multi-country longitudinal survey of older adult well-being and health. Physical activity was measured using the GPAQ instrument, tobacco use was based on response to a question on current use of any tobacco products, fruit and vegetable intake was based on responses to two separate questions regarding servings of fruits and vegetables consumed in a typical day, and medication adherence was based on whether respondents took recommended antihypertensive medication in the past two weeks. The Berkman-Syme Social Network Index (SNI) is a composite index of marital status, regular attendance at religious services, regular attendance at voluntary group meetings, and frequent socialization with friends and coworkers. The

associations between each hypertension management behavior and SNI were assessed in separate robust Poisson regressions adjusted for sociodemographic, health, and health system covariates.

Results:

The SNI was found to be associated only with having adequate levels of physical activity among respondents with known hypertension status, showing 86% increased likelihood of adequate physical activity for those most integrated. The association was stronger than that among those who do not self-report being hypertensive.

Conclusions:

There is some evidence of a positive association between social integration and improved hypertension management behavior, although limited only to the effect on physical activity and indicate no significant differences in the associations for men and women.

Introduction

Cardiovascular diseases are leading causes of mortality in Ghana, accounting for 18% of total premature deaths in 2012 [1]. Hypertension is a leading risk factor for CVD in Ghana, and has remained one of the top five causes for outpatient visits since 1990 [2]. Previous studies have found high and increasing prevalence of hypertension among both rural and urban populations in Ghana [3, 4]. Tobacco use, inadequate fruit and vegetable consumption, and physical inactivity also remain important risk factors for CVD [5], and are critical components for the management of hypertension [6].

Numerous studies have found associations between the level of an individual's connectedness in a social network and health and mortality outcomes [7–10], perhaps reducing the risk of mortality by 50% [11]. The level of social integration is hypothesized to influence health and mortality through multiple pathways [12]. Being well integrated may improve self-efficacy and promote adaptive coping in stressful conditions [12–14], as well as buffering against the physiological responses to stress [13, 15–18].

Another pathway is the influence of social integration on engagement in health promoting behaviors [12, 19–22]. The network of connections within which one is embedded acts a source of social control, establishing norms for health promoting behaviors, as well as providing tangible and emotional support

in dealing with health conditions [12, 23]. Berkman's Alameda County study found that there was a gradient in the association between levels of social integration and likelihood of engaging in poor health behaviors such as smoking and physical inactivity [8]. Likewise, other studies have found similarly positive associations between levels of social integration and health influencing behaviors such as physical activity [21, 24–26], smoking [21, 27], diet [21, 28], and treatment adherence [29–31]. Some studies have found that the associations may be different between men and women [7, 8, 32, 33], and a general measure of the structure of social relationships is more likely associated with less common health behaviors such as chronic disease management than with more common general health behaviors susceptible to the influence of social norms [34].

While there is considerable evidence of this relationship, this evidence stems from studies conducted in North America, Europe, and Asia [11]. The roles and expectations of social relationships are defined within the cultures and societies in which these relationships are embedded. Therefore, it is imperative that evidence of these associations be provided from different cultural milieus. This study will be the first to examine the association of a composite measure of social integration, the Berkman-Syme social network index (SNI), with health behaviors among a nationally representative sample of Ghanaian older adults with hypertension. We will also examine whether this relationship differs by

sex, as well as differences in the strength of association in the sample of older adults not reporting being hypertensive.

Methods

Study population

For this analysis, a subset of data collected in Ghana for Wave 1 of the WHO Study on Global Ageing and Adult Health (SAGE). SAGE is a multi-country longitudinal survey of nationally representative samples of adults aged 50 and older which aims to collect comparable, valid, and reliable data across several domains of health and well-being. Household and individual level data were collected from samples in China, Ghana, India, Mexico, Russian Federation, and South Africa. The analyses being conducted involve only one wave of data from Ghana. This publicly available data was accessed through a data repository from the Interuniversity Consortium for Political and Social Research (ICPSR) at the University of Michigan.

The sample was drawn from a sampling frame developed from Ghana's 2000 Population and Housing census and updated in 2007 before the data collection commenced [35]. This was stratified into the 10 administrative regions in the country, and the sampling frame included 250 enumeration areas (EA) selected from these strata [35]. The number of EAs selected from each stratum

was determined by probability proportional to size, with size being denoted by the number of EAs in each stratum. Selection of EAs within each stratum was then by probability proportional to EA size, with size being denoted by the number of 50 years and older individuals residing in an EA. In each selected EA, households were classified into one of three categories [35]:

- 1) A follow-up household from the 2003 WHO World Health Survey (WHS), also considered to be SAGE Wave 0, with one or more adults 50 years or older.
- 2) New households with at least one adult aged 50 years or older.
- 3) A SAGE Wave 0 follow-up household with no adults aged 50 or older but adults 18-49 years old.
- 4) New households with no adult 50 years or older but adults 18-49 years old.

For a target sample size of 5,000 50-plus households and 1,000 18-49 households, 24 households were to be selected in each EA, with 20 being 50-plus households [35]. All SAGE Wave 0 households (category 1) with at least one member 50 years or older were eligible for the interviews [35]. If there were not enough such households in an EA, the remaining 50-plus households were systematically selected from the list of new 50-plus households (category 2) [35]. Four SAGE Wave 0 households with adults less than 50 years old (category 4) were

randomly selected [36]. All adults 50 years and older in each household were eligible to be interviewed [35, 37]. One adult from each of the four 18-49 in each EA was randomly selected to be interviewed [37]. There were 5,178 households and 5,571 individuals selected for interviews. The household and individual response rates were 97.7% and 93.8%, respectively [35]. For this study, sample of 4,264 individuals aged 50 or older who completed the survey and had non-missing cluster and sample weight data were selected.

Data collection

The SAGE survey questionnaire was adapted from the instruments and methods used in the 2003 WHO World Health Survey (WHS) and pretested in 2005 with 1500 respondents in Ghana, India, and Tanzania [38]. The questionnaire consists of the following six main instruments: household questionnaire, individual questionnaire, proxy respondent questionnaire, proxy validation questionnaire, retest questionnaire, and verbal autopsy questionnaire [35]. The proxy validation and retest questionnaires were included as quality control measures [35].

Interviewers were trained and supervised during data collection. Data collection was conducted using paper and pencil during face to face interviews. If an individual selected for an interview was incapable of answering the

individual questionnaire due to inability to comprehend, the interview was conducted with a family member as a proxy. There were a total of 16 proxy interviews completed [36].

Measures

Dependent variables

Hypertension management behaviors and level of control were used as dependent variables in separate analyses. Hypertension management behaviors used in this analysis include medication adherence, current smoking status, level of physical activity, and vegetable and fruit intake. Hypertensive status was based on self-report of diagnosis of hypertension or measured blood pressure (BP). Measured BP was based on the mean of the last two of three measurements of diastolic BP (DBP) and systolic BP (SBP). Respondents with SBP \geq 140 mmHg or DBP \geq 90 mmHg were classified as having hypertension.

Respondents who reported as being diagnosed with hypertension were asked whether, in the last two weeks, they had taken medications that were recommended by a doctor for control of their hypertension. A dichotomous medication adherence variable was coded 1 for those who responded “yes” to this question and 0 otherwise.

Smoking status was derived from a survey question which asked respondents whether they currently use any tobacco products. Those responding “yes” were classified as current smokers.

Level of physical activity was derived from a series of questions on length and intensity of physical activity. These questions were adapted from the WHO’s global physical activity questionnaire (GPAQ) [39, 40]. GPAQ collects data on physical activity in three domains: activity at work, transport related physical activity, and recreational physical activity. This instrument has been found in several studies to be a valid and reliable measure of physical activity in disparate country and cultural settings, including in developing countries [39, 41, 42]. Responses to questions in the three domains are scored using a detailed algorithm [40]. In summary, moderate and vigorous activity are assigned four and eight metabolic equivalents (MET), respectively. One MET is equivalent to the energy cost of sitting without any activity, or 1 kcal/kg/hour. In each domain, total MET for moderate and vigorous physical activity are calculated separately by multiplying the amount of time per week spent engaging in such activity by the base MET of 4 or 8, and then summed for the domain MET. Transport related physical activity is classified as equivalent to moderate physical activity, without further sub-domains. For each individual, scores from all three domains were summed to arrive at the total MET-minutes of moderate and vigorous

physical activity per week. Using a WHO standard, MET scores were dichotomized, with weekly MET-minutes less than 600 being classified as inadequate physical activity and those greater than or equal to 600 being classified as adequate physical activity [40].

Amount of fruit and vegetable intake was derived from responses to two questions: (1) the number of servings of fruit consumed on a typical day, and (2) the number of servings of vegetables consumed on a typical day. Valid responses to these two questions were summed to arrive at a combined value for both fruit and vegetable intake. Using the WHO recommendation, a dichotomous variable was created for adequate fruit and vegetable intake, with less than 5 servings being classified as inadequate.

Main independent variable

Berkman and Syme's social network index (SNI) is a summary measure of the number of social relationships and contacts that an individual has on a regular basis [8]. Berkman and Syme developed and used this index in the Alameda county study on the association of social relationships with mortality [8]. The index has been used in several subsequent studies [7, 43–47, 11, 48]. The SNI was constructed using responses to questions in four areas of social ties: marital status, religious participation, participation in activities with friends and

coworkers (socially active), and group membership. Dichotomized variables were created for each indicator of social ties.

Marital status was coded 1 for those who reported being married or cohabiting, and 0 for all others. There is evidence that cohabitation may have similar benefits for health behavior as being married [49]. Religious participation was coded based on frequency of attendance, with those attending religious services at least once per week being coded as 1 and others coded as 0. Socially active was based on responses to three questions: the frequency of visits to the homes of friends, the frequency of visits by friends to a respondent's home, and the frequency of socialization with coworkers outside of work. A response of "daily" to any one of the three questions or weekly to all three questions was coded as 1 for socially active. Other combinations of responses were coded as 0 for socially active. Coding for group membership was based on frequency of attendance at voluntary group and club meetings. Responses indicating at least monthly attendance at such meetings were coded as 1 for group membership and 0 otherwise. The sum of the dichotomized responses was used to create levels for the SNI. Respondents with 0 to 1 significant ties were categorized into level I, while those with 2, 3, or 4 significant ties were categorized in levels II, III, and IV, respectively. This categorization follows similar practices utilized in previous studies [8, 46, 47, 50, 51].

Covariates

SAGE data contains information on respondents' various demographic characteristics, including sex, age, permanent wealth quintile, education, ethnicity, and residence. Permanent wealth quintile was already derived and included in the SAGE dataset, with the first quintile being poorest and the fifth quintile being wealthiest. The derivation of permanent wealth values from asset, household characteristic, and access to services data in the SAGE survey are described elsewhere [35, 37, 52]. The following categorical age bands were created from the continuous age variable: 50 to 59 years, 60 to 69 years, 70 to 79 years, and 80 plus. Educational status was categorized as "completed college", "completed secondary school", "primary or less", and "no formal education". Ethnicity was grouped into the following five categories: Akan, Ewe, Ga-Adangbe, Northern groups, and other. Urban residence was dichotomized (0 = no, 1 = yes).

Risk factors and health conditions that may confound or mediate the relationships of interest were also included in the analysis. These included self-rated health status, functional ability, alcohol consumption, living alone, and depression. Self-rated health status was derived based on response to the following survey question: "in general, how would you rate your health today?".

Possible responses were “very good”, “good”, “moderate”, “bad”, and “very bad”. A trichotomized health status variable was derived, with “very good” and “good” responses categorized as “good”, “bad” and “very bad” categorized as “poor”, and “moderate” remained categorized as “moderate”.

Functional ability was assessed based on the 12-item WHO disability assessment schedule, version 2 (WHODAS-II). These items were included as part of the SAGE questionnaire. WHODAS-II provides a generic instrument used to capture the level of health and functioning in the following six domains: (1) cognition, (2) mobility, (3) self-care, (4) getting along with others, (5) life activities such as domestic duties, school, leisure, and work, and (6) participation in the community and the society. Each domain was evaluated using two questions regarding level of difficulty in functioning in the previous 30 days. Possible responses were “none”, “mild”, “moderate”, “severe”, and “extreme – cannot do”. A summary score for all six domains was transformed onto a 0-100 scale to arrive at the WHODAS score, with higher scores indicating greater levels of difficulty in functioning. This was inverted to create a new WHODASi, such that a score of 100 indicated greatest functional ability while a score of 0 indicated least functional ability [53, 54]. A dichotomous WHODASi variable was created for use in the regression models, indicating whether or not a

respondent's score was at or above the median WHODASi score for the population of older adults in the sample (1 = yes, 0 = no).

Living alone was based on the number of people the respondent reported as living in the household. If the response is 1, then the dichotomous variable for living alone was coded as 1, otherwise 0.

Depression status was based on self-report of being diagnosed in the past 12 months or assessed based on the World Mental Health Survey Initiative Version of the World Health Organization Composite International Diagnostic Interview Short Form (CIDI-SF) [55]. In the latter, diagnosis of depression was based on criteria for depressive episodes from the International Classification of Disease tenth revision (ICD-10) diagnostic criteria for research [56]. To establish depression status, a symptom-based algorithm based on reports of depressive symptoms in the previous 12 months was used [57–59]. According to the ICD-10, respondents must affirm experiencing at least 4 of 10 depressive symptoms lasting most or all of the day for two weeks [56–59]. At least two of the following three symptoms must be present: depressed mood, loss of interest, or fatigability; along with any number of the following symptoms, for the minimum of 4 symptoms: loss of confidence or self-esteem, feeling of guilt, suicidal ideation or behavior, slow thinking or inability to concentrate, abnormally slow movement or restlessness, inability to sleep or waking too early, and loss of appetite.

Health system factors that may influence access to and utilization of health care services and therefore influence disease medication adherence were also included in the analyses. These included health insurance status and having an outpatient visit in the previous 12 months. Health insurance status was derived from response provided by head of household to question of whether the respondent had health insurance. A dichotomous insurance variable was coded 1 for responses indicating that the respondent had mandatory insurance, voluntary insurance, or both. Otherwise, the variable was coded as 0.

Statistical analysis

The relative risk associations of SNI and hypertension management behaviors were modeled using multivariable Poisson regression models with robust standard errors. A Poisson regression model with robust standard errors was chosen to directly estimate relative risk due to the relatively high prevalence of the outcomes [60] and issues of non-convergence in log-binomial models [61–64]. As previous studies have found that there may be differential associations of measures of social integration with health behavior by sex, interactions between sex and social integration index will be examined and if significant, stratified analysis will be conducted [8, 7, 32]. All regression analyses were performed using R version 3.2 and the R “survey” package [65].

Results

Table 4.1 is a comparison of sociodemographic characteristic by levels of social integration among the sample of older adult respondents who completed the survey. Significant differences in the distribution of these characteristics are indicated by the p-values.

Among the sample of respondents who completed the survey, 54.5% had mean systolic blood pressure ≥ 140 mmHG and/or mean diastolic blood pressure ≥ 90 mmHg. In contrast, only 14.2% reported being diagnosed as hypertensive. Among those who had blood pressure levels above the recommended thresholds, 80% were undiagnosed. Among those self-reporting as hypertensive, 70% took antihypertensive medication in the past two weeks, 63% had adequate levels of physical activity, 38% consumed the recommended 5 servings or more of fruits and vegetables in a typical day, and only 5% smoked.

To model the outcomes of different hypertension management behaviors and their associations with the social integration index, only the sample of respondents who self-reported being diagnosed with hypertension were selected for the analysis. Due to sparseness of responses in levels of some categorical variables, response levels were collapsed. Educational level was reduced from four to three categories: “no formal education”, “primary or less”, “and secondary or higher”. Categorical age was likewise reduced to three categories,

encompassing “50 to 59”, “60 to 69” and “70 plus”. A dichotomous health system responsiveness variable was created, indicating whether or not a respondent’s responsiveness score was greater than 80, equivalent to average responses of “good” or “very good” (1 = yes, 0 = no) in the seven health system responsiveness domains.

The results of the regression models for hypertension management behaviors are presented in Table 4.2. In unadjusted analyses relating each outcome to the SNI (Model 1), SNI was only significantly related to adequate levels of physical activity. Using those with 0 or 1 social tie as reference, the prevalence ratio ranged from 1.56 for those with two social ties to 2.12 for those with four social ties. This association remained significant when controlling for sociodemographic (Model 2) and health characteristics (Model 3). In the final model, those with 2 social ties had 48% (PR 1.48, 95% CI 1.20 – 1.81) higher likelihood of prevalent adequate level of physical activity, up to 86% (PR 1.86, 95% CI 1.50 – 2.31) higher for those with 4 social ties. There were no significant associations of the SNI with smoking, fruit and vegetable consumption, or medication adherence in the final models. Additional models including depression status and living alone were tested. These did not significantly change the coefficients of the SNI but provided worse model fit. They were therefore not included in the final model.

Interaction of the SNI with sex was tested in the final models for physical activity, fruit and vegetable consumption, and medication adherence outcomes. Due to the very low level of tobacco use among the sample, counts of tobacco users in categories of interaction terms were largely zeros. Thus interaction terms were not used for the smoking outcome. Only the interaction between SNI and sex in the model for fruit and vegetable consumption was significant. However, in stratified analyses by sex, coefficients for the SNI were not statistically significant at $\alpha = 0.05$.

To assess whether the composite measure was also associated with risk behaviors, models for tobacco use, fruit and vegetable consumption, and physical activity were evaluated for the sample of respondents who did not self-report being hypertensive. The results of the adjusted models are presented in Table 4.3. In the risk behavior model, higher social integration was associated with decreased likelihood of prevalent tobacco use, with significant coefficients for having 2 or 3 ties. However, a global Wald χ^2 test of coefficients at all social integration levels indicated that the effect was not statistically different from null ($\chi^2 = 6.8$, $df = 3$, $p = 0.079$). Having two social ties increased the likelihood of consuming adequate amounts of fruits and vegetables, although this association is not significant for 3 or 4 ties. Finally, increasing social ties significantly increased the likelihood of having adequate levels of physical activity. Tests of

interactions between the SNI and sex in the risk behavior models showed no significant interactions. Therefore, stratified analysis was not conducted.

These associations were similar to those found among those self-reporting hypertension, although the association of social integration and physical activity was notably stronger among those who self-report. In both analyses, there was a similar trend of decreasing likelihood of adequate fruit and vegetable consumption with increasing levels of social integration, although in neither case was this trend significant.

Discussion

Prior studies have shown important associations between measures of social integration with risk of mortality from different causes, and have hypothesized that one possible pathway between social integration and mortality may be health behavior. However, much of this evidence comes from studies conducted in North America, Europe, and to a lesser extent, Asia [11]. This is the first examination of this relationship between a composite measure of social integration and health behavior in Ghana and in a sub-Saharan African context.

In this study, level of social integration was significantly associated with having adequate levels of physical activity among respondents who have been diagnosed with hypertension. However, similar inferences could not be made for the association of social integration with the other disease management behaviors. Furthermore, this study failed to find that these associations differed between men and women, as some studies have found [32, 21, 33]. Some researchers have suggested that a structural measure of social relationships such as social integration may be more closely associated with disease management and other health behaviors that are less common within an individual's network of relations than with general preventive health behavior [34]. This study found that the association of social integration with level of physical activity was stronger among those who self-reported hypertension, and the strength of the

association increased with increasing level of social integration. This may be due to increased support and active encouragement from one's network of family and friends to engage in appropriate disease management behaviors.

There are several limitations with this study. This is a cross-sectional study, and as such is only able to reveal potential associations between the health behaviors and social integration. Whether there is a causal relationship, and the direction of such a relationship, cannot be ascertained with this study design. The measures of interest were assessed based on self-report and are likely subject to reporting bias. Furthermore, in deriving the components of the social integration index, it is possible that different choices for cutoffs may result in different associations with the composite index. However, this study followed conventions used in prior studies in setting the cut-offs. Finally, while attempts were made to adjust for covariates that may mediate or confound the associations of interest, there may be omitted-variables bias.

One of the strengths of the SAGE study is its longitudinal design. While this analysis found some evidence for the association of a composite social integration measure with health behavior, analyses using multiple waves of SAGE data will make it possible to examine the temporality of these relationships. It will also be possible to assess whether social integration is related to subsequent mortality, and whether such a relationship is mediated by

health behaviors. For intervention planning, it will be important to know what aspects of these relationships are most important for improved disease management and risk behaviors, particularly among older adults. Additional research can examine the role specific aspects of social support play in promoting proper disease management and risk behaviors.

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Table 4.1 : Sociodemographic and health characteristics by level of social integration

	Social Integration Index				p-value*
	I (low) (n=1419)	II (n=1264)	III (n=1089)	IV (high) (n=469)	
Sex, n (%)					<0.001
Male	562 (39.3)	642 (51.6)	641 (57.9)	373 (79.3)	
Female	857 (60.7)	622 (48.4)	448 (42.1)	96 (20.7)	
Age category, n (%)					<0.001
50 to 59	423 (31.7)	500 (40.7)	504 (45.3)	244 (49.5)	
60 to 69	386 (26.5)	366 (28.4)	305 (27.6)	128 (26.9)	
70 to 79	387 (26.5)	296 (23.3)	205 (19.8)	72 (18.1)	
80+	223 (15.2)	102 (7.6)	75 (7.3)	25 (5.5)	
Education, n (%)					<0.001
No formal education	910 (62.8)	692 (53.8)	515 (47.8)	196 (40.8)	
Less than primary	123 (9.1)	126 (9.6)	120 (11.6)	53 (12.6)	
Completed primary	131 (9.1)	143 (11.7)	126 (12.0)	62 (12.9)	
Completed Jr. high	187 (14.5)	198 (17.0)	211 (18.5)	104 (23.2)	
Completed secondary	33 (2.3)	54 (4.5)	54 (4.5)	32 (6.9)	
University/post-grad	27 (2.1)	40 (3.3)	54 (5.5)	21 (3.5)	
Wealth quintile, n (%)					<0.001
First (poorest)	388 (24.9)	237 (17.2)	159 (14.3)	59 (11.0)	
Second	298 (20.4)	284 (21.3)	189 (17.7)	65 (12.3)	
Third	251 (18.8)	266 (21.3)	218 (19.7)	111 (26.0)	
Fourth	234 (16.8)	231 (19.4)	279 (26.3)	118 (23.1)	
Fifth (wealthiest)	246 (19.1)	242 (20.8)	242 (22.0)	116 (27.6)	
Employment, n (%)					<0.001
Agricultural	434 (31.6)	563 (45.0)	527 (48.4)	292 (62.4)	
Non-agricultural	284 (21.5)	315 (27.0)	337 (31.3)	121 (25.1)	
Not employed	636 (47.0)	347 (28.1)	200 (20.3)	52 (12.5)	
Urban Residence, n (%)	603 (43.4)	522 (41.6)	446 (40.4)	162 (35.3)	0.32
Ethnicity, n (%)					0.02
Akan	650 (45.2)	608 (47.6)	554 (54.0)	217 (49.9)	
Ewe	97 (6.7)	70 (6.3)	90 (8.9)	32 (8.0)	
Ga-Adangbe	176 (13.1)	124 (10.6)	100 (8.4)	36 (8.3)	
Northern groups	149 (12.4)	148 (11.6)	116 (11.4)	70 (14.1)	
Other	330 (22.5)	296 (24.0)	203 (17.3)	97 (19.6)	
Self-rated health status, n (%)					<0.001
Poor	378 (27.4)	191 (14.7)	128 (12.9)	18 (4.2)	
Moderate	628 (42.3)	552 (43.3)	430 (39.3)	200 (41.6)	
Good	410 (30.3)	521 (42.0)	531 (47.9)	251 (54.2)	
Live alone, n (%)	198 (12.4)	131 (9.0)	99 (8.0)	19 (3.3)	<0.001

Depressive, n (%)	117 (8.6)	57 (4.3)	93 (8.7)	71 (14.3)	<0.001
Median WHODASi score (IQR)	81.2 (27.1)	83.3 (22.9)	87.5 (22.9)	91.7 (18.8)	<0.001
Insured, n (%)	547 (38.6)	445 (35.7)	442 (39.7)	189 (40.0)	0.33
Outpatient last 12 months, n (%)	832 (66.3)	782 (68.2)	663 (66.6)	229 (54.2)	<0.001
<i>*Significance based on adjusted Wald χ^2 test for categorical variables and Kruskal-Wallis test for medians of continuous variables; weighted counts were used for significance testing</i> <i>IQR: Interquartile range</i>					

Table 4.2 : Prevalence ratio associations of social integration with hypertension management behavior				
Level of social integration	Model 1 ^a	Model 2 ^b	Model 3 ^c	Model 4 ^d
	PR (95% CI)	PR (95% CI)	PR (95% CI)	PR (95% CI)
Current Tobacco Use^e				
SNI Level	(n=577)	(n=574)	(n=526)	
I	Reference	Reference	Reference	
II	0.79 (0.32, 1.94)	0.62 (0.27, 1.42)	0.73 (0.31, 1.72)	
III	0.51 (0.19, 1.38)	0.38 (0.13, 1.14)	0.36 (0.12, 1.14)	
IV	0.55 (0.12, 2.56)	0.36 (0.07, 1.76)	0.44 (0.09, 2.24)	
Adequate physical activity				
SNI Level	(n=577)	(n=566)	(n=519)	
I	Reference	Reference	Reference	
II	1.56 (1.25, 1.96)	1.51 (1.22, 1.87)	1.48 (1.20, 1.81)	
III	1.86 (1.50, 2.29)	1.79 (1.47, 2.17)	1.68 (1.38, 2.04)	
IV	2.12 (1.70, 2.63)	2.01 (1.62, 2.50)	1.86 (1.50, 2.31)	
Adequate fruit and vegetable consumption				
SNI Level	(n=577)	(n=566)	(n=519)	
I	Reference	Reference	Reference	
II	0.99 (0.75, 1.31)	0.99 (0.76, 1.28)	1.01 (0.77, 1.32)	
III	0.85 (0.62, 1.16)	0.83 (0.60, 1.16)	0.87 (0.62, 1.24)	
IV	0.79 (0.47, 1.34)	0.73 (0.40, 1.31)	0.86 (0.48, 1.57)	
Medication Adherence				
SNI Level	(n=576)	(n=565)	(n=518)	(n=500)
I	Reference	Reference	Reference	Reference
II	1.09 (0.93, 1.27)	1.07 (0.92, 1.23)	1.04 (0.89, 1.20)	1.02 (0.88, 1.18)
III	1.06 (0.90, 1.24)	1.04 (0.89, 1.22)	1.04 (0.88, 1.22)	1.04 (0.90, 1.20)
IV	0.99 (0.77, 1.28)	0.97 (0.73, 1.27)	0.96 (0.73, 1.27)	0.97 (0.75, 1.26)
^a Crude bivariate association ^b Additionally adjusted for sex, wealth quintile, education, and ethnicity ^c Additionally adjusted for poor health, WHODAS score, and alcohol use ^d Additionally adjusted for health insurance and outpatient visit in past 12 months ^e For tobacco use outcome, wealth quintile and ethnicity were highly collinear with SNI and were not included in models 2 and 3. SNI: Social Network Index <i>Note: all regressions were adjusted for complex survey design using 'survey' package in R.</i>				

Table 4.3 : Prevalence ratio associations of social integration with CVD risk behavior			
CVD risk behavior, PR (95% CI)			
Social Network Index	Tobacco Use	Fruit and Vegetable consumption	Physical activity
I	Reference	Reference	Reference
II	0.77 (0.62, 0.97)	1.36 (1.16, 1.61)	1.26 (1.20, 1.33)
III	0.72 (0.54, 0.97)	1.19 (0.97, 1.45)	1.31 (1.23, 1.40)
IV	0.90 (0.63, 1.29)	0.91 (0.68, 1.20)	1.41 (1.32, 1.52)
<i>Note: Models adjusted for sex, age, wealth quintile, education, ethnicity, poor health, WHODAS score, and alcohol use</i>			

Chapter 5: Conclusion

Cardiovascular diseases account for a significant proportion of the disease burden in Ghana. Hypertension is of high prevalence and a leading risk factor for CVD. Levels of risk behavior, awareness of diagnostic status, and appropriate management are inadequate and avenues for intervention need to be explored. Social relationships have been found to have significant associations with health behaviors in numerous studies, although much of the evidence stems from studies conducted in developed country contexts. This study examines the association of a composite measure of social ties with cardiovascular risk behavior among a nationally representative sample of Ghanaian older adults. It also examined what important access to care factors may influence likelihood of awareness. Summarized below are the implications for policy and future research, as well as the strengths and limitations of this study.

Summary of results

This dissertation sought to address the following aims:

- To examine the association between distinct social ties and CVD risk behavior among a cohort of Ghanaian older adults
- To examine what factors that may be associated with lack of awareness of hypertension diagnostic status among this sample

- To examine whether a composite social integration measure was associated with improved hypertension management behavior, and whether this composite index was also significantly associated with the risk behaviors among non-hypertensive older adults.

The findings in Paper 1 suggest that the different social ties are associated with risk behaviors, and some associations were different between men and women. Religious attendance had a positive association with adequate levels of physical activity and fruit and vegetable consumption among both men and women, and a negative association with likelihood of tobacco use among men. Group membership was positively associated with the likelihood of adequate physical activity among both men and women. However, group membership significantly reduced the likelihood of adequate fruit and vegetable consumption among men and women, and socially active women were at an increased risk of tobacco use.

The analyses in Paper 2 found that barriers to accessing care were significantly associated with lack of awareness of hypertension diagnostic status. However, patient perceptions of the responsiveness of care were not significantly associated with awareness.

In Paper 3, the results indicated that a composite index of social integration composed of the separate social ties was only significantly associated

with physical activity, among both those with known hypertension status and those who were unaware.

Implications for policy and intervention

A key challenge for health in Ghana is the integration of prevention and management of chronic NCDs into a health system primarily designed to address the very significant burden of infectious diseases. Improvements are needed at multiple levels, and policies and interventions should leverage the important role that communities and social relationships play in disease prevention and management [1–3]. A draft strategy for combatting NCDs in Ghana calls for multi-sectoral approaches for primary prevention, early detection, and clinical care, as well as measures to strengthen the health system, improve risk factor surveillance, and to develop a research regime to inform policies and interventions [4]. Risk factors for chronic diseases develop from earlier ages and progress to disease at later stages. This underlies the need for increased attention to integration of prevention, treatment, and care throughout the life-course. Health systems must not only draft policy but also mobilize sustained resources to address

Primary care has been found to be of poor quality, thus people chose to seek care at secondary or tertiary facilities once a condition worsens [5].

Improving human resource capacity, both in the availability of health care

workers and the quality of their training, will be important for increasing utilization and improving awareness and care for chronic conditions. Increased community engagement for education about prevention, care seeking, and management of hypertension and other CVD risk factors is needed.

The management of chronic conditions occur largely outside the healthcare encounter, and likely involves one's network of social relationships. This study has found that these relationships may be important factors in the proper management of disease. Interventions should seek to engage health care providers with family and social network of patients in order to improve continued adherence to behavior change and medication interventions. The health system should leverage the role of communities and social relations in disease prevention and management through behavior change interventions. Caregiving options can be expanded through integration of social supports. Ghana's NCD strategy should be expanded to better incorporate the role of social networks in interventions.

Implications for research

This study found an association of structural measures of social relationships with health behavior. Future research can examine the importance of the functional aspects of these relationships and their role in health behavior.

In particular, future research could examine the kinds of groups and associations older Ghanaians engage with and how they impact the different risk behaviors. New research can also examine the potential gains in cost-effectiveness through the utilization of social networks in improving NCD prevention and management. Additional waves of the SAGE study can provide an opportunity to test whether these health behaviors mediate the association between social ties and mortality found in earlier studies [6–8].

Strengths and limitations

This is the first study to examine the role of social integration on health behavior in Ghana. It uses nationally representative data on older adults to answer important questions about the prevention and control of hypertension, a leading cause of CVD morbidity in Ghana. There are several limitations. The cross-sectional nature of the data means that temporality and the direction of causality in the observed associations cannot be determined. Measures of risk and hypertension management behaviors were based on self-report and thus prone to reporting bias. In creating the indicators for social ties, different cutoffs could have been used, and it is possible that associations may vary depending on the choice of cutoffs. Finally, the associations found could be spurious, and there may have been bias due to omitted variables. However, the inclusion of sociodemographic and other covariates likely minimized this possibility.

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Appendix

Curriculum Vita

Jonathan K. Akuoku, MA

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EDUCATION

Johns Hopkins Bloomberg School of Public Health
Doctor of Philosophy in Public Health, Health Systems Baltimore, MD
2016

University of Chicago
M.A. in Social Service Administration Chicago, IL
2009
Policy and Management Track

Cornell University
B.A. in Sociology Ithaca, NY
2003

EXPERIENCE

The World Bank
Consultant Washington, DC
Oct 2013 - Present

- Conduct analysis of potential lives saved for maternal and childhood nutrition interventions across multiple countries using the Lives Saved Tool (LiST)
- Develop and implement methodology for estimating the DALY impacts of maternal and childhood nutrition interventions
- Develop and conduct a training for World Bank staff on lives saved estimation using LiST
- Develop and conduct a training for World Bank staff on DALY calculations

Johns Hopkins Bloomberg School of Public Health
Teaching Assistant – Case Studies in Management Decision Making Baltimore, MD
Jan 2015 – Mar 2015

- Facilitated class sessions, arranging for guest speakers and ensuring readiness and availability of course materials
- Provided guidance to students on completion of course assignments
- Maintained course website

Johns Hopkins University's Center for Communication Programs
Research Assistant Northern Region, Ghana
Feb 2014 – April 2014

- Revised research protocol and data collection instruments for qualitative study on outdoor sleeping and malaria risk in rural Ghana
- Conducted training and selection of data collectors on qualitative research and data collection methods
- Supervised selection of households and individuals for study participation
- Supervised field staff during data collection, ensuring high level of data quality
- Using Atlas TI, will conduct analysis of in-depth interviews and observations data
- Along with a team, will prepare a manuscript for publication

Johns Hopkins University Bloomberg School of Public Health Baltimore, MD
Teaching Assistant – Critical Issues in TB Research and Control **Oct 2012 – Dec 2012**

- Facilitated class sessions, arranging for guest speakers and ensuring readiness and availability of course materials
- Provided guidance to students on completion of course assignments
- Maintained course website

Johns Hopkins Bloomberg School of Public Health Baltimore, MD
Teaching Assistant – Economic Evaluation II **Jan 2012 – Mar 2012**

- Provided guidance on understanding and completing class assignments and projects
- Graded and provided feedback to students on assignments
- Provided assistance to students on use of course software (TreeAge, Excel)
- Led tutorial on conducting cost-effectiveness analysis using TreeAge

Johns Hopkins Bloomberg School of Public Health Dhaka, Bangladesh
Internal Monitor and QC Specialist – SATT Clinical Trial **Mar 2011 – Dec 2011**

- Led a team to develop manual of standard operating procedures for a clinical trial on home-based treatment of neonatal sepsis
- Conducted regular monitoring of recruitment, enrollment, and follow-up of study participants to ensure adherence to ethical guidelines and study protocol
- Developed protocols for assuring study data quality and streamlined documentation of data management procedures
- Conducted statistical analysis to identify issues in study implementation and provided feedback to research team for continued improvement
- Contributed to data analysis and periodic report writing
- As part of a team, managed the setup and implementation of the study at new site
- Conducted periodic site visits and wrote detailed reports on monitoring and quality assurance activities

Johns Hopkins University Bloomberg School of Public Health Baltimore, MD
Research Assistant – Road Safety in 10 Countries Project **May 2010 – Feb 2011**

- Assisted in management of data collection activities in Cambodia and Vietnam
- Analyzed primary and secondary data on road traffic injuries and impact of

- implemented interventions
- Authored the baseline report on road traffic injury situation in Cambodia

PLOWS Council on Aging

Chicago, IL

Administrative Intern

Aug 2008 – May 2009

- Reviewed and revised program and administrative policies to meet regulatory and contractual requirements
- Conducted statistical analysis of home care program data to justify costs to state department on aging

Cook County Juvenile Court Clinic

Chicago, IL

Intern

Sep 2007 – Jun 2008

- Conducted intake interviews with juveniles and parents involved in court proceedings
- Through review of records and psychosocial interviews, wrote resource memos to address the treatment needs of juveniles engaged in proceedings
- Assisted in the analysis of data for the evaluation of outcomes of treatment recommendations

Immigrant and Refugee Community Organization

Portland, OR

Case Management Supervisor, Senior District Center

Feb 2006 – Jul 2007

- Supervised 5 case managers engaged with assisting community older adults maintain their independent living
- Worked with center manager to identify and address staff training needs
- Coordinated services with other local organizations to meet needs of clients
- Improved programming of center's MS Access database to better respond to our information needs
- Engaged in advocacy at state and local levels to support the center's activities

Guardianship Program of Dade County

Miami, FL

Case Manager

Oct 2004 – Dec 2005

- Coordinated and monitored the care of 80 individuals appointed to the public guardian
- Through consultations with a multidisciplinary team, made medical, social, and financial decisions aimed at meeting clients' psychosocial needs
- Provided monthly reports on clients' well-being to the probate court

Center for Independent Living of South Florida

Miami, FL

Project Director, Housing and Transition Program

Sep 2003 – Jul 2004

- Supervised two staff members engaged in transitioning institutionalized persons with disabilities back to community living
- Collaborated with other local agencies and organizations to support clients' independent living goals
- Conducted outreach and education to identify potential clients for community

transition

PUBLICATIONS

- Tran NT, **Akuoku JK**, Sann S, Gnim C, Sem P, & Hyder AA. 2011. Road Safety in 10 Countries: Cambodia baseline report
- Niessen LW, Mohan D, **Akuoku J**, Koehlmoos T, Trujillo A, & Peters DH. 2012. Chronic disease and poverty in low and middle income settings – a systematic review [under review]
- Shekar M, Kakietek J, D'Alimonte M, Eberwein JD, Rogers H, **Akuoku JK**, Soe-Lin S, Pereira A, & Hecht R. 2016. Reaching the global target to reduce stunting: how much will it cost and how to pay for it? [under review]

AWARDS

- Hartford Geriatric Leadership Fellow (2008-2009)
- Kott Gerontology Scholar Internship (2008-2009)